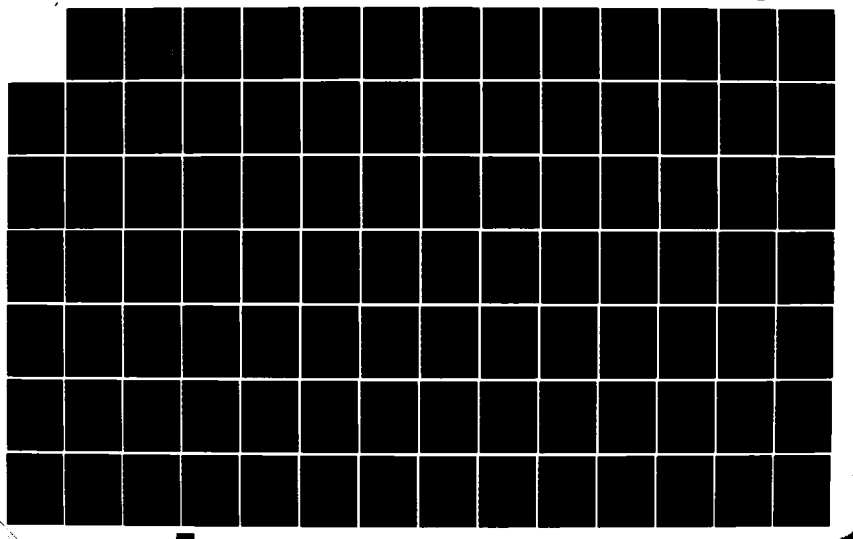
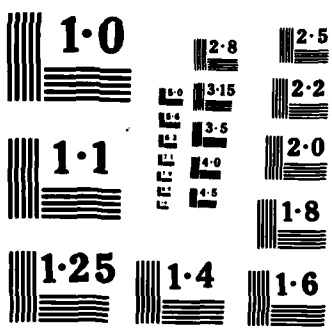
AD-A152 186 MAINTENANCE DREDGING OF ATLANTIC INTRACOASTAL WATERWAY SOUTH CAROLINA(U) CORPS OF ENGINEERS CHARLESTON SC CHARLESTON DISTRICT APR 76 1/2

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FINAL

ENVIRONMENTAL STATEMENT

MAINTENANCE DREDGING OF ATLANTIC

INTRACOASTAL WATERWAY, SOUTH CAROLINA

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Prepared by
U. S. ARMY ENGINEER DISTRICT, CHARLESTON, SOUTH CAROLINA
April 1976

found to be involved they cannot be avoided by following reasonable alternative courses of action which would achieve the congressionally specified purposes; that where the proposed action has an adverse effect, this effect is either ameliorated or substantially outweighed by other considerations of national policy; that the recommended action is consonant with national policy, statutes, and administrative directives; and that on balance the total public interest should best be served by the implementation of the recommendation.

26 January 1976
Date

HARRY S. WILSON, JR.
Colonel, Corps of Engineers
District Engineer

I have reviewed the Statement of Findings and concur with the recommendations of the District Engineer.

Date 17 March 1976

CARROLL N. LeTELLIER
Major General, USA
Division Engineer

I concur in the preceding Statement of Findings.

Date 10 April 1976

ERNEST GRAVES
Major General, USA
Director of Civil Works

Statement of Findings

Operation and Maintenance of the Atlantic Intracoastal Waterway, Little River to Port Royal Sound, South Carolina

1. I have reviewed and evaluated, in light of the overall public interest, the documents concerning the proposed action, as well as the stated views of other interested agencies and the concerned public, relative to the various practicable alternatives in accomplishing the maintenance of navigational improvements in the AIWW.

2. The possible consequences of these alternatives have been studied for environmental, social well-being, and economic effects, including regional and national economic development and engineering feasibility.

3. In evaluation of the selected and other viable alternatives, I found the following considerations pertinent:

a. Environmental. I did not select the alternative ("no action") with the least environmental impact. The "no action" alternative would provide none of the benefits described in b, c and d below. The selected method of utilizing diked sites already in use for the disposal of dredged material has the least environmental impact of the alternatives requiring disposal. The interagency coordination of all dredging work should insure that the environmental damage of maintenance dredging is held to the minimum consistent with the overall public interest. No new marsh areas will be selected for the disposal of dredged material unless no other feasible alternatives can be found.

b. Social well-being. Although none of the alternatives would have effects on social well-being of the same magnitude as the effects on the environment, engineering or the economy, the recommended alternative provides more potential in this area than the "no action" plan, and provides a potential equal to that of all other alternatives.

c. Engineering. Project dimensions were based on the requirements necessary to realize the benefits authorized in the 1937 Rivers and Harbors Committee Doc. 6, 75th Cong., 1st Sess. Safety, maneuverability and drag on vessels were considered.

d. Economic. The recommended plan is justified on the basis of savings to commercial traffic alone. Substantial benefits to recreational traffic, plus land enhancement, and defense benefits, further argue for the recommended plan.

4. I find that the action proposed is based on thorough analysis and evaluation of various practicable alternative courses of action for achieving the stated objectives; that wherever adverse effects are

85 03 15 097

SUMMARY

Maintenance Dredging of Atlantic Intracoastal Waterway, South Carolina

( ) Draft (X) Final Environmental Statement

Responsible Office: U. S. Army Engineer District
P. O. Box 919
Charleston, South Carolina 29402
Telephone: 803-577-4171, Ext. 229

1. Name of Action: (X) Administrative ( ) Legislative

2. Description of Action: Maintenance of a channel 12 feet deep at mean low water and not less than 90 feet wide in the Atlantic Intracoastal Waterway (AIWW) from Little River to and including Port Royal Sound, with a branch channel of the same dimensions to McClellanville, a total distance of 210 miles.

3. a. Environmental Impacts: Short-term increase in turbidity and sedimentation; smothering of plant and animal communities in disposal areas; temporary frightening of birds and mammals in the area; temporary reduction of phytoplankton and zooplankton; short-term reduction of benthic organism populations in the path of the cutterhead; increase in the local mosquito population; possible adverse effect on fish larvae due to increased turbidity; possible reduction in dissolved oxygen levels as a result of the dredge disturbing organic materials undergoing anaerobic decomposition; minor increase in air pollution during dredging operations; and improvement of navigation with associated benefits to commercial shippers, the fishing industry, and recreational boaters.

b. Adverse Environmental Effects: Temporary increase in turbidity and siltation in the vicinity of the dredge; temporary decrease in primary production resulting from increased water turbidity; possible reduction in dissolved oxygen levels as a result of the dredge disturbing organic materials undergoing anaerobic decomposition; possible displacement of wildlife species; alteration of existing vegetation in disposal areas; destruction of some benthic organisms by the cutterhead; and increase in the local mosquito population.

4. Alternatives: Dredging and conveyance of material to an offshore disposal area, alternate upland disposal sites, use of all dredged material in a marsh building program, and no action.

5. Comments received from:

Forest Service, USDA
U. S. Department of the Interior
Environmental Protection Agency
U. S. Department of Commerce

5. Comments received from: (cont.)

U. S. Federal Power Commission
Soil Conservation Service, USDA
Federal Highway Administration, USDT
U. S. Department of Health, Education and Welfare
U. S. Department of Housing and Urban Development
State Planning and Grants Division, Office of the Governor
South Carolina State Land Resources Conservation Commission
South Carolina Wildlife and Marine Resources Department
South Carolina Department of Archives and History
(State Historic Preservation Officer)
South Carolina State Archeologist
South Carolina Department of Health and Environmental Control,
(Division of Vector Control)
South Carolina Department of Health and Environmental Control,
(Programs Development Division)
Environmental Defense Fund, Inc.
South Carolina Environmental Coalition

6. Draft Statement to CEQ 15 September 1975 .

Final Statement to CEQ 13 April 1976 .

Draft
Environmental Statement
Maintenance Dredging of Atlantic Intracoastal Waterway,
South Carolina

Table of Contents

	Para. No.	Page No.
Project Description	1.0	1
General	1.01	1
Project authorization	1.02	1
History of AIWW dredging in the Charleston District	1.03	6
Disposal of dredged materials	1.04	11
Special studies	1.05	12
Environmental Setting Without the Project	2.0	14
General	2.01	14
Other Federal projects	2.02	14
Little River Inlet	2.02.01	14
Waccamaw River	2.02.02	16
Georgetown Harbor Project	2.02.03	16
Town Creek	2.02.04	16
Cooper River Rediversion Project	2.02.05	16
Charleston Harbor	2.02.06	17
Charleston Harbor Navigation Study	2.02.07	18
Ashley River	2.02.08	18
Port Royal Sound	2.02.09	19
Anchorage and wharves	2.03	19
Geology	2.04	19
Mineral resources	2.04.09	22
Soils	2.05	22
Beaufort	2.05.01	22
Charleston County	2.05.02	23
Colleton County	2.05.03	23
Georgetown County	2.05.04	24
Horry County	2.05.05	25
Hydrology	2.06	25
Ground water	2.06.01	25
Water table aquifers	2.06.01.1	25
Deep aquifers	2.06.01.2	26
Salt water intrusion	2.06.01.3	26
Water supply and use	2.06.01.4	27
Tidal hydrology	2.06.02	27
Water quality	2.07	27
Climatology	2.08	31
Biotic communities	2.09	31
General	2.09.01	31
Coastal fringe communities	2.09.02	33
Beach	2.09.02.1	34
Dune	2.09.02.2	34
Maritime shrub thicket	2.09.02.3	35
Maritime forest	2.09.02.4	36

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Justification
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	Para. No.	Page No.
Coastal plain communities	2.09.03	37
Cypress swamps	2.09.03.1	37
Savannah and pine flatwoods	2.09.03.2	38
Oak-pine forest	2.09.03.3	39
Pocosins	2.09.03.4	40
Carolina bays	2.09.03.5	41
Inland marshes	2.09.03.6	42
Lakes and ponds	2.09.03.7	43
Estuarine communities	2.09.04	44
Open waters	2.09.04.1	44
Tidal marshes	2.09.04.2	47
Tidal flats	2.09.04.3	51
Dredged material islands	2.09.04.4	51
Other communities	2.09.05	53
Agricultural lands	2.09.05.1	53
Man-dominated communities	2.09.05.2	54
Rare and endangered animal species	2.09.06	55
Endangered species	2.09.06.1	55
Threatened species	2.09.06.2	55
Peripheral species	2.09.06.3	55
Status undetermined species	2.09.06.4	56
Rare and endangered plant species	2.09.07	56
Historical and archeaological sites	2.10	57
Historical sites	2.10.01	57
Horry County	2.10.01.1	57
Georgetown County	2.10.01.2	57
Charleston County	2.10.01.3	57
Colleton County	2.10.01.4	58
Beaufort County	2.10.01.5	58
Archaeological sites	2.10.02	58
Socio-economics	2.11	58
Population	2.11.01	58
Economic development	2.11.02	59
General	2.11.02.1	59
Commercial fishing	2.11.02.2	59
Recreation and tourism	2.11.02.3	61
Employment	2.11.02.4	61
Income	2.11.02.5	61
Waterway vessel traffic	2.11.02.6	63
Relationship of Proposed Action to Land Use Plans	3.0	64
The Probable Impact of the Proposed Action on the Environment	4.0	64
General	4.01	64
Water quality	4.02	65
Biological resources	4.03	66
Benthic organisms	4.03.01	66
Plankton	4.03.02	67
Phytoplankton	4.03.02.1	67
Zooplankton	4.03.02.2	67

	Para. No.	Page No.
Fish and commercial and sport fisheries	4.03.03	67
Marsh	4.03.04	69
Beach, dune and maritime shrub thicket	4.03.05	70
Urbanized land	4.03.06	70
Woodlands	4.03.07	70
Agricultural lands	4.03.08	71
Rare and endangered species	4.03.09	72
Rare and endangered animal species	4.03.09.1	72
Rare and endangered plant species	4.03.09.2	72
Mosquitoes	4.03.10	72
Archaeological and historical sites	4.04	73
Aesthetics	4.05	73
Noise and air quality	4.06	73
Socio-economic conditions	4.07	73
Any Probable Adverse Environmental Effects Which Cannot be Avoided	5.0	74
Alternatives to the Proposed Action	6.0	74
No action	6.01	74
Relocation of disposal areas	6.02	75
Alternate upland sites	6.02.01	75
Open water disposal	6.02.02	76
Beach disposal	6.02.03	76
Ocean disposal	6.02.04	77
The Relationship Between Local Short-term Uses of Man's Environment and the Maintenance and Enhancement of Long-term Productivity	7.0	77
Any Irreversible and Irretrievable Commitments of Resources Which Would be Involved in the Proposed Action	8.0	78
Coordination and Comment and Response	9.0	78
Government Agencies	9.01	78
Citizens and citizen groups	9.02	78
List of References		

List of Figures

No.		
1	AIWW Little River to Winyah Bay	3
2	AIWW Winyah Bay to Charleston	4
3	AIWW Charleston to Port Royal Sound	5
4	Index Map, River and Harbor Works, Charleston District	15

List of Tables

No.		
1	Controlling dimensions of the AIWW channel	1 & 2
2	Estimates of annual shoaling rates based on dredging during the period 1956 through 1974 on the AIWW from Little River to Port Royal Sound	7 8
3	AIWW areas with serious shoaling problem	28
4	Tides at selected stations along the AIWW	30
5	Intracoastal Waterway sediments data	32
6	Climatological data for period of record	60
7	Commercial fishery landings for the period 1964-1974	62
8	Work force estimates	
9	Comparative statement of traffic on the South Carolina AIWW, 1964-1973	63

List of Appendices

A Letter of Comment on Draft EIS

B Aerial mosaics of the South Carolina AIWW

1.0 Project Description

1.01 General. The existing project provides for a waterway 12 feet deep at mean low water (mlw) and not less than 90 feet wide from Little River to and including Port Royal Sound, with a branch channel of the same dimensions to McClellanville, a total distance of 210 miles; for the construction of three bridges crossing the waterway in Horry County, S. C.; and for an anchorage basin 125 feet wide, 335 feet long, and 12 feet deep near Myrtle Beach, S. C. The project was completed in 1940 except for the anchorage basin which has not been constructed. Controlling dimensions of the channel at various points along the waterway as of 1 November 1974 are presented in Table 1. The existing project is shown on Figures 1, 2, and 3 and on the aerial mosaics presented in Appendix A. Total cost for new construction to date is $7,455,378. Total maintenance costs to date are $17,960,217. The Fiscal Year of 1976 budget amount for Corps of Engineers' operations and maintenance work on this project is $1,921,000.

1.02 Project authorizations. The existing project, completed in 1940, was authorized by the following River and Harbor Acts: September 19, 1890; June 13, 1902-H. Doc. 63rd Cong., 1st Sess.; March 3, 1925-S. Doc. 178, 68th Cong., 2nd Sess.; July 3, 1930-H. Doc. 41, 71st Cong., 1st Sess.; August 30, 1935-Rivers and Harbors Committee Doc. 14, 72nd Cong., 1st Sess.; August 31, 1935-Rivers and Harbors Committee Doc. 11, 72nd Cong., 1st Sess.; August 26, 1937-Rivers and Harbors Committee Doc. 6, 75th Song., 1st Sess.; March 2, 1945-H. Doc. 327, 76th Cong., 1st Sess.

Table 1

Controlling Dimensions of the AIWW* Channel

Reach	Length in Statute Miles	Project Width	*Depth
Little River to Winyah Bay Section			June 1974
1. Little River Inlet to U.S. Hwy 17 Bridge	5.3	90'	12.0
2. U.S. Hwy 17 Bridge to White Point Creek	5.9	90'	12.0
3. White Point Creek to U.S. Hwy 501 Bridge	12.2	90'	12.0
4. U.S. Hwy 501 Bridge to S.C. Hwy 544 Bridge	5.6	90'	12.0
5. S.C. Hwy 544 to Bucksport	6.0	90'	12.0
6. Bucksport to Brookgreen Gardens	10.4	(a)	12.0
7. Brookgreen Gardens to Lafayette Bridge	14.5	(a)	12.0

Table 1 (cont.)

Controlling Dimensions of the AIWW* Channel

	Reach	Length in Statute Miles	Project Width	*Depth
	Winyah Bay to Charleston Section			Sept 1974
8.	Lafayette Bridge to N. end E&M Canal	8.9	(a)	12.0
9.	N. end E&M Canal to S. end E&M Canal	5.1	90'	9.8
10.	S. end E&M Canal to N. end 4 Mile Creek	2.5	90'	9.4
11.	N. end 4 Mile Creek to S. end 4 Mile Creek	2.1	90'	9.9
12.	S. end 4 Mile Creek to Casino Creek	5.4	90'	10.7
13.	Casino Creek to McClellanville	4.2	90'	10.9
				Sept 1974
Note	Branch Channel to McClellanville	(0.8)	(90')	8.4
14.	McClellanville to Mouth Harbor River	5.7	90'	9.3
15.	Mouth Harbor River to Venning Creek	8.2	90'	12.0
16.	Venning Creek to Price Inlet	4.4	90'	12.0
17.	Price Inlet to Capers Inlet	3.6	90'	12.0
18.	Capers Inlet to Dewees Inlet	3.0	90'	12.0
19.	Dewees Inlet to Ben Sawyers Bridge	7.2	90'	9.1
20.	Ben Sawyer Bridge to Charleston	5.3	90'	12.0
	Charleston to Port Royal Section			Aug 1974
21.	Charleston to Junction Stono River	4.5	90'	12.0
22.	Junction Stono River to Johns Is Hwy Br	7.3	(a)	12.0
23.	Johns Is Hwy Br to Yonges Island	11.7	90'	12.0
24.	Yonges Island to Dawho River Bridge	10.3	90'	12.0
25.	Dawho River Bridge to South Edisto River	3.4	90'	12.0
26.	South Edisto River to Fenwick Cut	7.3	(a)	12.0
27.	Fenwick Cut to Combahee River	5.9	(a)	12.0
28.	Combahee River to Brickyard Creek	10.1	(a)	12.0
29.	Brickyard Creek to Beaufort	8.0	90'	12.0
30.	Beaufort to Skull Creek	16.0	(a)	12.0

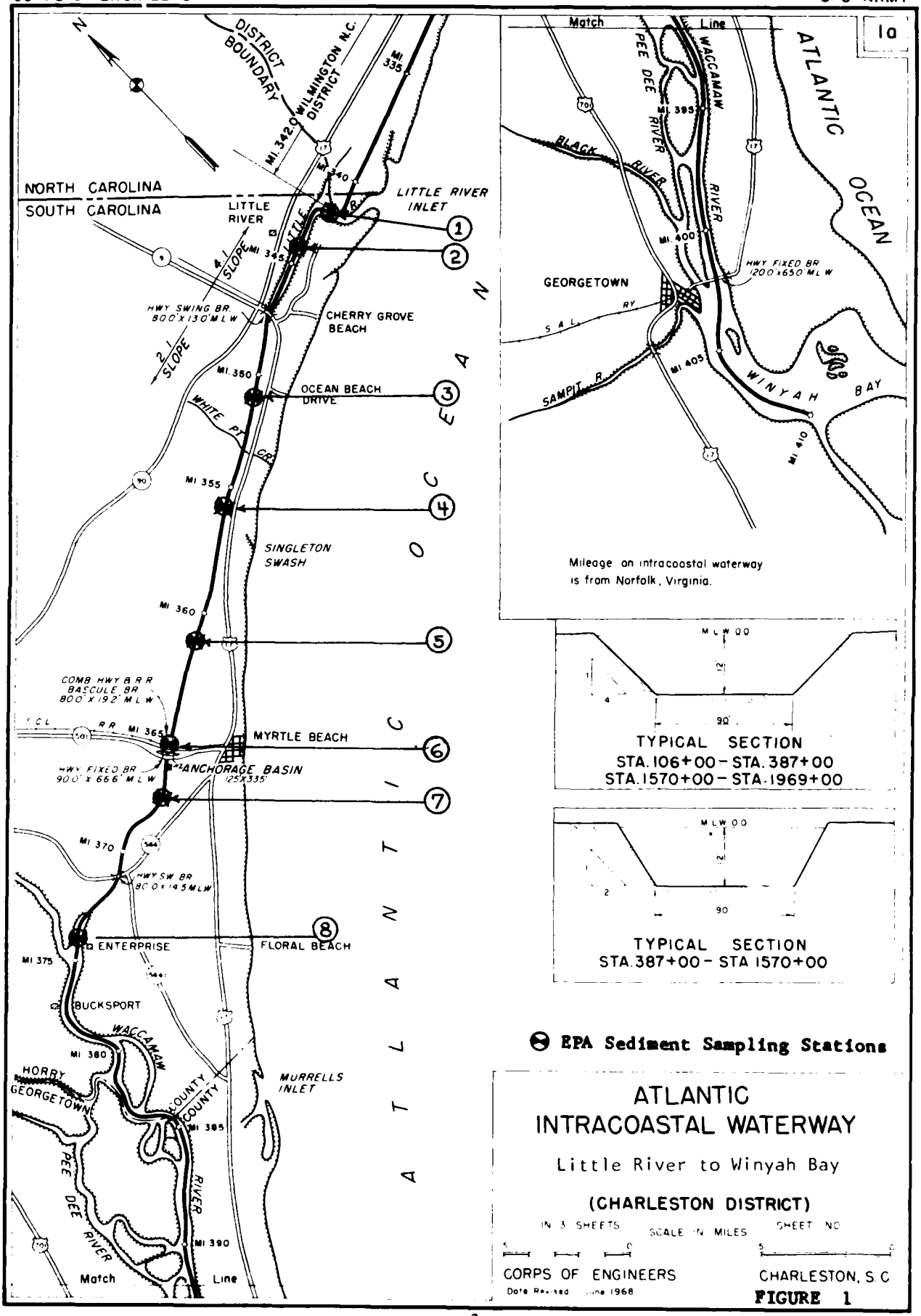
NOTE: * Based on after-dredging survey May-Sept 1974 or centerline surveys Nov 1973-Jan 1974.
(a) Natural channel exceeds project width of 90' for waterway.

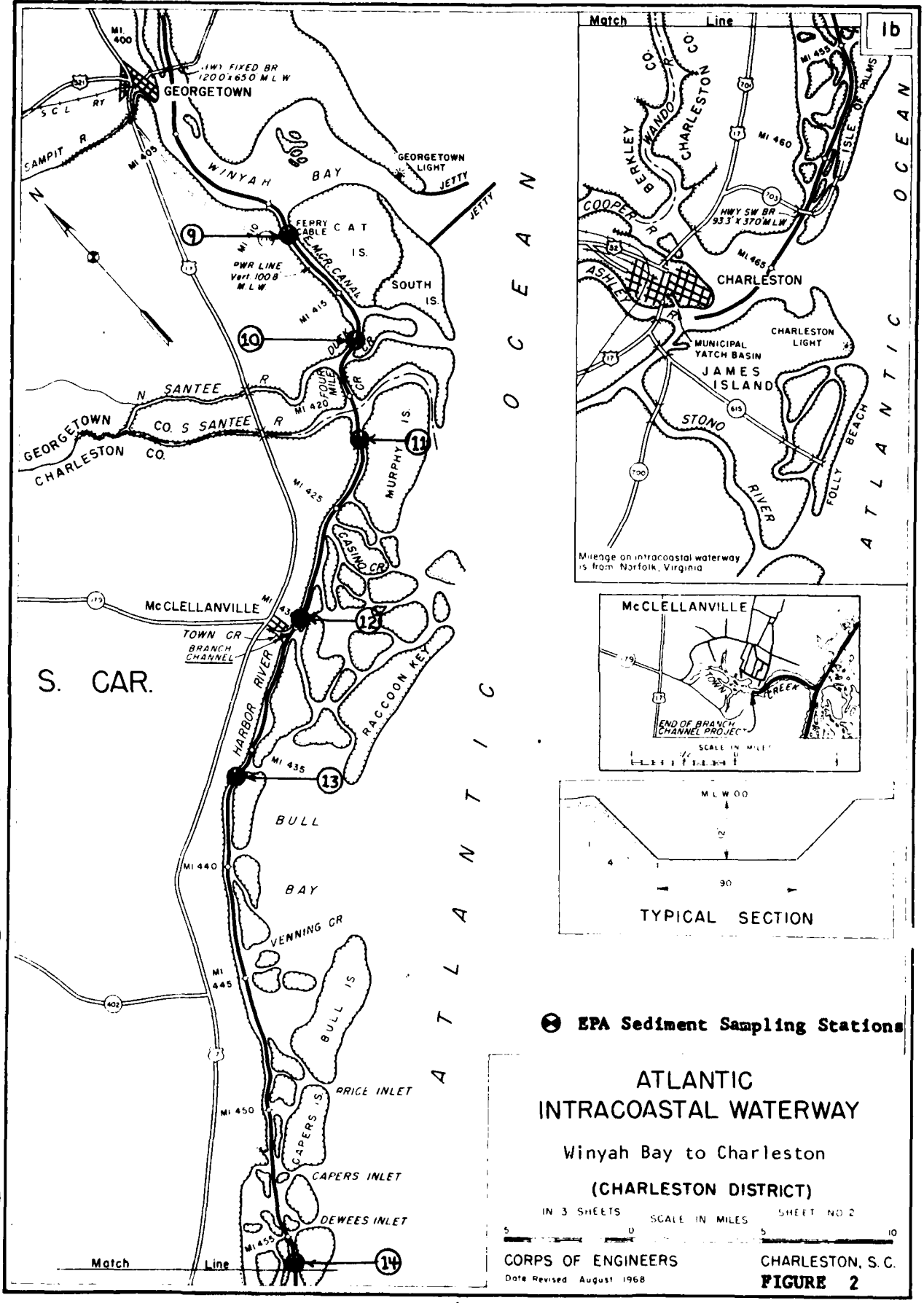
The datum plane to which the controlling depths, listed in this table are referred is as follows:

Little River to Winyah Bay, South Carolina - Local mean low water.

Winyah Bay to Charleston, South Carolina - Mean low water in the ocean. (Equivalent to local mean low water.)

Charleston to Port Royal Sound South Carolina - Local mean low water


1a
N
DISTRICT BOUNDARY
WILMINGTON N.C. DISTRICT
MI 342.0
MI 335
MI 340
NORTH CAROLINA
SOUTH CAROLINA
LITTLE RIVER
LITTLE R.
LITTLE RIVER INLET
1
2
4:1 SLOPE
MI 345
HWY SWING BR. 800'X130'M L W
CHERRY GROVE BEACH
2:1 SLOPE
MI 350
OCEAN BEACH DRIVE
3
WHITE PT. CR.
MI 355
4
SINGLETON SWASH
MI 360
5
COMB. HWY & R R BASCULE BR. 800'X192' M L W
C C L
R R
MI 365
MYRTLE BEACH
6
HWY FIXED BR 900' X 666' M L W
ANCHORAGE BASIN (25'X335')
7
MI 370
HWY SW BR 80'X 145'M L W
8
ENTERPRISE
FLORAL BEACH
MI 375
BUCKSPORT
WACCAMAW
MI 380
HORRY COUNTY
GEORGETOWN COUNTY
MURRELLS INLET
MI 385
PEE DEE RIVER
MI 390
Match Line
ATLANTIC OCEAN
Match Line
PEE DEE RIVER
WACCAMAW
MI 395
BLACK RIVER
RIVER
MI 400
HWY FIXED BR 1200'x650' M L W
GEORGETOWN
S A L RY
SAMPIT R.
MI 405
WINYAH BAY
MI 410
ATLANTIC OCEAN
Mileage on intracoastal waterway is from Norfolk, Virginia.
M L W 00
12
4
90
TYPICAL SECTION
STA. 106+00 - STA. 387+00
STA. 1570+00 - STA. 1969+00
M L W 00
12
2
90
TYPICAL SECTION
STA. 387+00 - STA 1570+00
EPA Sediment Sampling Stations
ATLANTIC INTRACOASTAL WATERWAY
Little River to Winyah Bay
(CHARLESTON DISTRICT)
IN 3 SHEETS
SCALE IN MILES
SHEET NO
5 0 5
CORPS OF ENGINEERS
CHARLESTON, S.C
Date Revised June 1968
FIGURE 1



ATLANTIC INTRACOASTAL WATERWAY

Winyah Bay to Charleston

(CHARLESTON DISTRICT)

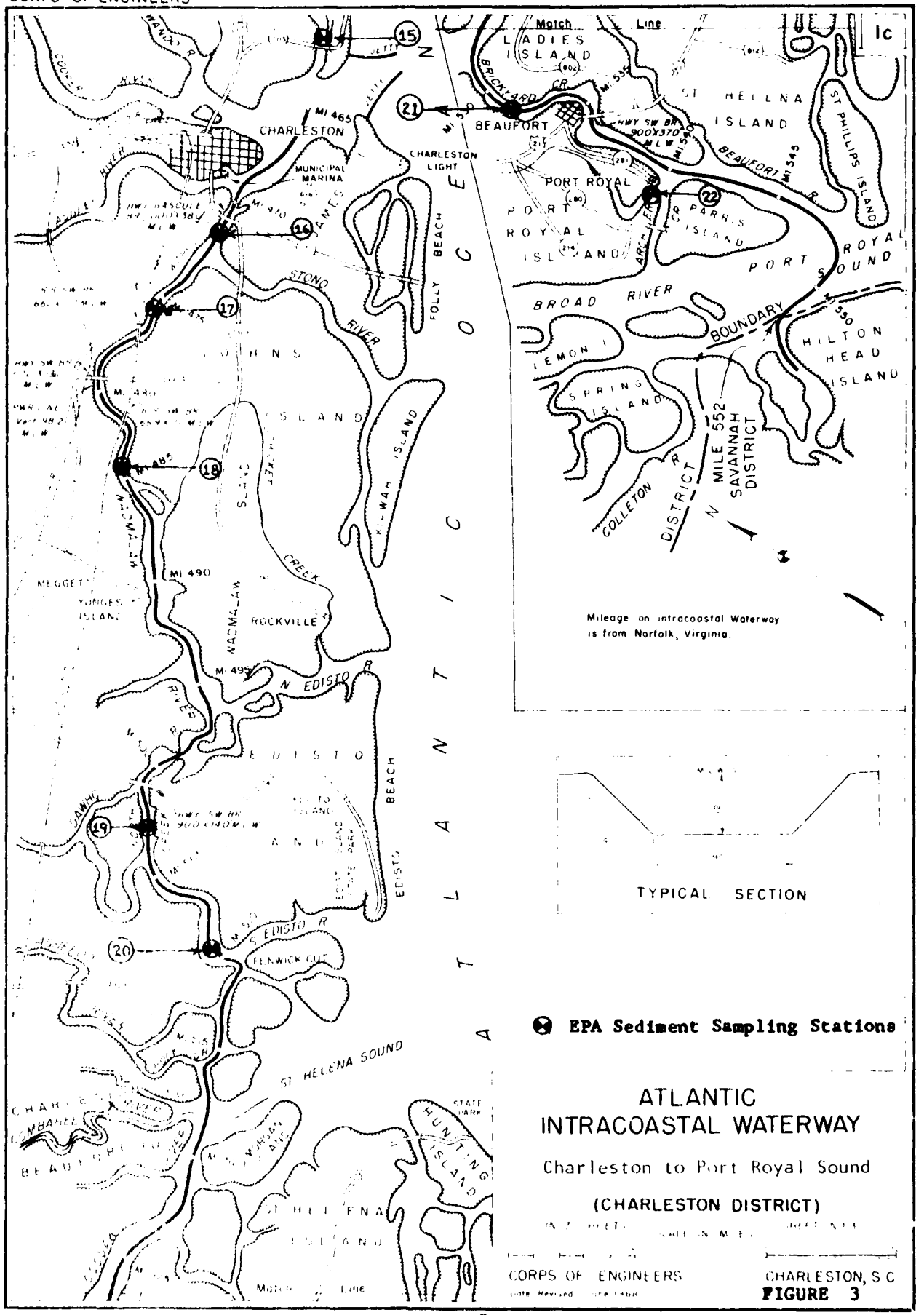
IN 3 SHEETS SCALE IN MILES SHEET NO 2

5 0 5 10

CORPS OF ENGINEERS CHARLESTON, S. C.

Date Revised August 1968

FIGURE 2


Match Line
Ic
LADIES ISLAND
BRICKYARD CR
BEAUFORT
ST HELENA ISLAND
ST PHILLIPS ISLAND
BEAUFORT R
PORT ROYAL
PORT ROYAL ISLAND
ARCHER CR
PARRIS ISLAND
PORT ROYAL SOUND
BROAD RIVER
BOUNDARY
HILTON HEAD ISLAND
LEMON I
SPRING ISLAND
COLLETON R
DISTRICT
N
MILE 552
SAVANNAH DISTRICT
CHARLESTON
MUNICIPAL MARINA
CHARLESTON LIGHT
JAMES I
FOLLY BEACH
STONO RIVER
JOHNS ISLAND
KIAWAH ISLAND
KITTIWAH
SLAUGHTER CREEK
MEGGETT
YONGES ISLAND
ROCKVILLE
WADMALAW
N EDISTO R
EDISTO BEACH
EDISTO ISLAND
EDISTO BEACH STATE PARK
S EDISTO R
FENWICK CUT
ST HELENA SOUND
CHARLESTON HARBOR
BEAUFORT RIVER
HUNTING ISLAND
STATE PARK
ST HELENA ISLAND
Match Line
ATLANTIC OCEAN
Mileage on intracoastal Waterway is from Norfolk, Virginia.
TYPICAL SECTION
EPA Sediment Sampling Stations
ATLANTIC
INTRACOASTAL WATERWAY
Charleston to Port Royal Sound
(CHARLESTON DISTRICT)
CORPS OF ENGINEERS
CHARLESTON, S C
FIGURE 3

1.03 History of dredging in the Charleston District. Prior to 1937, authorization provided for a channel 8 feet deep and 75 feet wide from Southport, N. C., at the mouth of Cape Fear River, to Georgetown on Winyah Bay, a distance of 95.2 miles, thence 10 feet deep and 90 feet wide to Charleston Harbor, a distance of 62.8 miles, thence 7 feet deep and 75 feet wide to Savannah, a further distance of 120 miles. In 1937, based on justification presented in the August 26, 1937 Rivers and Harbors Committee Document No. 6, 75th Cong., 1st Session, authorization was provided for deepening and maintenance of a channel 12 feet deep and 90 feet wide. A future annual tonnage of 661,950 was predicted for seven categories of shipping. A 12 foot channel was justified based on this tonnage, on the savings realized by shipping in larger, more economical vessels already in use to the north of the proposed project. Traffic data for 1974 show that tonnage in 3 categories accounts for over 1,000,000 tons, and total tonnage shipped through this section of the AIWW was 1,573,786. In a 1969 benefits and cost analysis, transport by AIWW yielded a savings of $0.018 per ton-mile over other methods of transport. For an 185,098,160 average annual ton-miles of traffic, $3,300,000 in commercial shipping benefits were estimated. In addition recreation, land enhancement and defense benefits were realized. Rough estimates for 1974 traffic indicate a savings of $0.012 per ton-mile over other methods of transport. For the recently experienced 171,581,743 ton-miles, commercial shipping benefits of $2,058,981 were estimated. Several areas along the waterway are subject to shoaling problems of varying degree of severity. Shoals are generally created by deposition of sediments from runoff, tidal action, and channel bed and bank erosion and occur most frequently where the AIWW passes ocean inlets. The interaction of cross currents in these areas causes current velocities to decelerate and allows heavier sediments to drop out of suspension. Shoals may also occur where channel waters are sluggish and in landcuts where vessel wakes cause erosion of channel banks. Sediment buildup in shallow waters creates navigational problems and, in places, may impede or severely restrict through boa traffic. Groundings are not uncommon in the waterway and sometimes result in costly boat damage and time delays. Dredging of the shoals is therefore necessary to facilitate safe navigation on the project channel and to maintain required channel dimensions. Cutterhead pipeline dredges are now used for all waterway dredging.

1.03.01 The greatest amount of dredging required to maintain authorized channel dimensions on that part of the AIWW in Charleston District is found on the reach between Georgetown and Charleston (Figure 2 and 3). About 18.2 million cubic yards have been removed from this reach since 1956 compared to about 4.6 million cubic yards from the reach from Little River to Georgetown (Figure 1) and 6.5 million from the Charleston to Beaufort reach (Figure 3). Shoaling rates for the entire project from Little River to Beaufort are presented in Table 2. Although the rate of shoaling has not been extremely high, dredging has been required on most of the waterway between Little River and the Waccamaw River near Georgetown. The greatest shoaling of this reach has occurred in the vicinity of Myrtle Farms Golf Course just north of Myrtle Beach. The reach is essentially a land-cut canal that intersects only a few streams. The remainder of the waterway, however, intersects numerous rivers and streams. While high rates of shoaling are found in the cuts between old streambeds, there are stretches of waterway along

Table 2

Estimate of Annual Shoaling Rates Based on Dredging During the Period
1956 Through 1974 on the AIWW from Little River to Port Royal Sound

Shoal No.	Location	Sta. to Sta. in 100 ft.	Length of Reach in ft.	Dredging 1956 through 1974 Total in c.y.	Total in c.y./ft.	Avg. Annual in cy/ft/yr	Years Dredged 1964-1974	Avg. Vol. Dredged Per Year Since 1956	Total Est. Pd. Cu. Yds. Next 50 Years	Acres of Disposal Area Required 1/
NORTHERN DISTRICT BOUNDARY AT MILE 342 TO WINYAH BAY										
1A	Little River to Ocean Forest	108 to 1100	99,200	2,906,681	29.3	1.5	64, 65, 66, 67, 69, 70, 72, 74	152,983	7,649,150	119
2A	Myrtle Farms	1100 to 1200	10,000	687,757	68.8	3.6	64, 65, 66, 67, 69, 72, 74	36,198	1,809,900	28
3A	Myrtle Beach to 1.4 miles north of Socastee Bridge	1200 to 1572	37,200	1,029,500	27.7	1.5	64, 65, 66, 67, 69, 72	54,184	2,709,200	42
TOTAL, NORTHERN PORTION			146,400 or 28 miles	4,623,938	31.6	1.7		243,365	12,168,250	189
WINYAH BAY TO CHARLESTON										
1B	Winyah Bay to Cat Island	1521 to 1400N	12,100	2,151,124	177.8	9.4	65, 67, 68, 69, 70, 71 72, 74	113,217	5,660,850	88
2B	Minim Creek to N. Santee River	1261N to 1151N	11,100	2,118,107	190.8	10.0	65, 67, 68, 69, 70, 71, 72, 74	111,479	5,573,950	86
3B	N. Santee River to S. Santee River	1132N to 1006N	12,600	972,942	77.2	4.1	65, 66, 67, 68, 69, 70, 71, 72, 74	51,207	2,560,350	40
4B	Mile 425 to Casino Cr.	766N to 738N	2,800	75,000	26.9	1.4	65, 72	3,947	197,350	3
5B	McClellanville to Harbor River	624N to 300N	32,400	3,138,744	96.9	5.1	65, 67, 68, 69, 70, 72, 74	165,197	8,259,850	128
6B	McClellanville Side Channel	0 to 40.27	4,027	989,129	245.6	12.9	None	52,059	2,602,950	40
7B	Harbor River	264N to 202N	6,200	332,681	53.7	2.8	65, 66, 68, 69 71, 74	17,510	875,500	14
8B	Awendaw Ramp to Belvedere Creek	150N to 166S	31,600	4,214,684	133.4	7.0	65, 66, 67, 68, 69, 70, 71, 72, 74	221,825	11,091,250	172
9B	Andersonville to Price Creek	260S to 388S	12,800	207,200	16.2	0.8	65	10,905	545,250	8
10B	Price Creek to Mary Bay	452S to 546S	9,400	292,282	31.1	1.6	65, 67, 70, 74	15,383	769,150	12
11B	Tomer Creek to Dewees Island	679S to 740S	6,100	583,200	95.6	5.0	65, 68, 72	30,695	1,534,750	24
12B	Morgan Creek to Ben Sawyer Bridge	906S to 1192S	28,600	2,957,666	103.4	5.4	65, 66, 67, 69, 70, 72, 74	155,667	7,783,350	121
13B	Charleston Harbor to Sullivans Island	1281S to 1294S	1,300	180,700	139.0	7.3	68	9,511	475,550	7
TOTAL, CENTRAL PORTION			171,027	18,213,859	106.5	5.6		958,602	47,930,100	743
CHARLESTON TO SOUTHERN DISTRICT BOUNDARY AT MILE 552										
1C	Wappoo Creek at Ashley River	-1 to 11	1,200	16,600	13.8	0.7	None	874	43,700	1
2C	Wappoo Creek at River-land Terrace	105 to 111	600	5,400	9.0	0.5	64	284	14,200	0.2
3C	Stono River	456 to 471	1,500	25,600	17.1	0.9	72	1,347	67,350	1
4C	Stono River	517 to 604	8,700	351,200	40.4	2.1	64, 65, 66, 69, 72	18,484	924,200	14
5C	Dawho River	1505 to 1526	2,100	143,487	68.3	3.6	68, 72, 74	7,552	377,600	6
6C	Dawho River	1586 to 1614	2,800	131,349	46.9	2.5	66, 72, 74	6,913	345,650	5
7C	Dawho River	1652 to 1654	200	7,200	36.0	1.9	64	379	18,950	3
8C	Dawho River to S. Edisto River	1683 to 1848	16,500	2,636,756	159.8	8.4	64, 65, 66, 67, 69, 70, 72, 74	138,777	6,938,850	108
9C	South Edisto River	1903 to 1949	4,600	157,000	34.1	1.8	68, 72	8,263	413,150	6
10C	South Edisto River	2124 to 2174	5,000	536,791	107.4	5.7	65, 67, 68, 69, 70, 72, 74	28,252	1,412,600	22
11C	Fenwick Cut (S Edisto to Ashepoo)	2232 to 2252	2,000	53,404	26.7	1.4	65, 68, 72, 74	2,811	140,550	2
12C	Ashepoo R -Rock Creek Cut-off	2455 to 2483	2,800	487,695	174.2	9.2	64, 66, 67, 68, 69, 70, 72, 74	25,668	1,283,400	20
13C	Rock Cr. - Coosaw River	2504 to 2583	7,900	1,849,749	234.1	12.3	64, 66, 67, 68, 69, 70, 72, 74	97,355	4,867,750	75
14C	Brickyard Creek	3298 to 3313	1,500	116,700	77.8	4.1	None	6,142	307,100	5
TOTAL, SOUTHERN PORTION			57,400 or 11 miles	6,518,931	113.6	6.0		343,101	17,155,050	266

1/ Based on the assumption that in situ material has a compaction ratio of 2:1 and will be piled 20 feet high in a diked disposal area.

Table 3

AIWW Areas with Serious Shoaling Problem

CY/LF/Yr. Rate of Shoaling	Priority Based on Shoaling Rate	Shoal No.	Description of Shoal	Reach: Little River to Georgetown	Reach: Georgetown to Charleston	Reach: Charleston to Beaufort
12.4	1	6B	McClellanville Side Channel		X	
12	2	13C	Rock Creek-Coosaw River Cutoff			X
10	3	2B	Minim Creek to N. Santee River		X	
9	4	12C	Ashepoo River-Rock Creek Cutoff			X
9	5	1B	Winyah Bay to Cat Island		X	
8	6	8C	Dawho River to S. Edisto River			X
7	7	8B	Awendaw Ramp to Belvedere Creek		X	
5	8	5B	McClellanville to Harbor River		X	
5	9	11B	Tomer Creek to Dewees Island		X	
5	10	10C	South Edisto River			X
5	11	12B	Morgan Creek to Ben Sawyer Bridge		X	
4	12	14C	Brickyard Creek			X
4	13	3B	North Santee River to South Santee River		X	
4	14	2A	Myrtle Farms	X		
3	15	5C	Dawho River			X
2.5	16	7B	Harbor River		X	

old streams with more than adequate channel size. The 16 major problem areas, beginning with the highest shoaling rate and continuing in order of decreasing severity, are discussed in the following paragraphs and summarized in Table 3.

1.03.02 McClellanville Side Channel. This 4,027-foot channel is a part of Jeremy Creek and has had a high rate of shoaling during the past 19 years. A total of 989,129 cubic yards has been dredged from this side channel during this period for an average annual amount of 12.9 cubic yards per linear foot of channel. The channel being maintained begins at the junction of the AIWW main channel near Mile 430 and terminates at the McClellanville main dock area. The fishing village of McClellanville is located 39 road miles northeast of Charleston and 21 road miles southwest of Georgetown.

1.03.03 Ashepoo-Coosaw Cutoff. There are two bad shoals on this cutoff, both of which are in the channel adjacent to Ashe Island about 15 statute miles by water from Beaufort. The cutoff between Rock Creek and Coosaw River, a distance of 7,900 feet, has an annual shoaling rate of about 12 cubic yards per linear foot. Over 1.8 million cubic yards of material have been dredged from this area during the 19 year period, 1956 through 1974. The shoaling rate is also high in a 2,800 foot section between Ashepoo River and Rock Creek. The total 19-year dredging was 487,695 cubic yards for this section amounting to an annual rate of about 9 cubic yards per foot. Stations of these two shoals are as follows: Rock Creek to Coosaw River, 2504+00 to 2583+00; and Ashepoo River through Rock Creek, 2455+00 to 2483+00.

1.03.04 Minim Creek to N. Santee River. The total 19-year dredging of about two miles of the Waterway in this reach between Station 1261+50N and Station 1151+00N was 2,118,107 cubic yards. This is an average of 10 cubic yards annually per linear foot of channel. The shoal begins at Minim Creek, about 11 statute miles by water from Georgetown heading toward Charleston, and ends at the AIWW intersection of the North Santee River. This section of channel generally follows the Duck Creek run separating Minim Island on the West and Crow Island on the East.

1.03.05 Winyah Bay to Cat Island. This shoal area begins at Winyah Bay about seven miles below Georgetown and runs about 12,000 feet down the AIWW toward Charleston. About 2,151,124 cubic yards have been dredged during the past 19 years and the average annual amount per linear foot of shoaled channel is nine cubic yards. The beginning station is 1521+30N at Winyah Bay. The land-cut through Cat Island has been filling at this high rate to Station 1400+00N.

1.03.06 Dawho River to South Edisto River. The longest continuous shoal between Charleston and Beaufort is the one that connects the Dawho River to the South Edisto River. This shoal, consisting of enlargement of North Creek and creation of Watts Cut, runs for 16,500 feet from Station 1683+00 just east of S. C. Highway 174 to Station 1848+00. Annual shoaling is about eight cubic yards per linear foot of channel length. A total of 2,636,756 cubic yards has been dredged from this shoal since 1956. Location of this area is about halfway between Charleston and Beaufort, more precisely, 28 miles below Charleston and 26 miles upcoast from Beaufort.

1.03.07 Awendaw Ramp to Belvedere Creek. More dredging, over four million cubic yards in 19 years, has been performed in this reach than in any other in the Charleston District's part of the AIWW. The shoal begins just below the oyster packing house and boat ramp at Awendaw (Station 150+00N) and ends at the head-out end of Belvedere Creek (Station 166+00S), a distance of 31,600 feet. This is the longest shoal between Georgetown and Charleston and has an annual shoaling rate of seven cubic yards per foot of length.

1.03.08 McClellanville to Harbor River. This shoal, between Georgetown and Charleston, begins above McClellanville at Station 624+00N, extends 32,400 feet down the AIWW, and enters the Harbor River about one mile below Tibwin Village at Station 300+00N. The total amount of dredging was about three million cubic yards over 19 years, and the annual shoaling averages about five cubic yards per foot of shoal.

1.03.09 Tomer Creek to Dewees Island. Also on the Georgetown-Charleston reach there is a serious shoaling problem from Tomer Creek, Station 679+00S (Mile 454) to Station 740+00S in Bullyard Sound adjacent to Dewees Island. The shoaling rate per linear foot of this 6100-foot section of the Waterway has been estimated at five cubic yards per year or a total of 583,200 cubic yards during the period 1956-1973.

1.03.10 South Edisto River. On the reach between Charleston and Beaufort along the South Edisto River, there is a stretch of waterway 5,000 feet long with a serious shoaling problem. Between 1956 and 1974, 536,791 cubic yards of material have been removed from this reach between Station 2124+00 and Station 2174+00. The annual shoaling rate is about 5.7 cubic yards per foot of channel length.

1.03.11 Morgan Creek to Ben Sawyer Bridge. A 28,600-foot section of the AIWW between Georgetown and Charleston behind Isle of Palms and Sullivans Island is a shoaling-problem area. The shoal reaches from Morgan Creek, Station 906+00S, to the Ben Sawyer Bridge on S. C. Highway 703, Station 1192+00S. It has an annual maintenance dredging rate of 5.4 cubic yards per foot of channel length. About 2.9 million cubic yards of material have been removed during the last 19 years.

1.03.12 Brickyard Creek. A short section of the Waterway just above Beaufort (station 3298+00 to Station 3313+00) and rather isolated from any other shoals has been filling-in at a rate of about four cubic yards per linear foot per year for the past 19 years. A total of 116,700 cubic yards has been removed from this 1500-foot section during this period.

1.03.13 North Santee River to South Santee River. Another shoal area on the reach from Georgetown to Charleston begins at the North Santee River (Station 1132+00N) and continues southward for 12,300 feet along Four Mile Creek Canal. About four cubic yards of material per linear foot are being removed from this shoal annually. Total dredging for the last 19 years has amounted to 972,942 cubic yards.

1.03.14 Myrtle Farms. Maintenance dredging has been required on most of the reach from Little River to Charleston but only about 10,000 feet has a very high rate of shoaling. From Station 1100+00 (Mile 361) to Station 1200+00, about 3.6 cubic yards per linear foot has been dredged annually throughout the past 19 years or a total of 687,757 cubic yards. This shoal area is located along Myrtle Farms Golf Course about 3.5 miles north of Myrtle Beach.

1.03.15 Dawho River. Over 140,000 cubic yards of material has been dredged from this 2,100 foot shoal in the Dawho River which is located between Charleston and Beaufort. The annual rate of shoaling for this reach is 3.6 cubic yards per foot of channel.

1.03.16 Harbor River. A relatively high rate of shoaling has been experienced along the Harbor River portion of the AIWW between Station 264+00N and 202+00N. This area is on the reach between Georgetown and Charleston. About 332,600 cubic yards have been dredged from this 6,200 foot shoal over the past 19 years, resulting in an average rate of shoaling of 2.8 cubic yards per year for each foot of channel dredged.

1.04 Disposal of dredged materials. Material dredged from the waterway is now deposited in diked disposal areas located on former marsh- and contiguous uplands (see Appendix B). The State of South Carolina, as the project sponsor, is required to furnish disposal sites for this and other similar projects. When the waterway was constructed in the mid-1930's, the State of South Carolina obtained disposal area easements along the waterway. These easements parallel the waterway, on one side or the other, extending back about 1,000 feet from the edge of the water. For many years following construction, dredged materials were pumped onto this 1,000-foot wide strip. Small dikes were occasionally constructed on the waterway side to prevent material from running back into the channel. However, after a number of years, it became evident that some of the material was re-entering the waterway from the backside. To prevent this, the disposal areas are now surrounded by a dike.

1.04.01 Most of the land within the disposal easement is coastal marshland which is a valuable component of the estuarine system. The importance of these marshes was not fully appreciated when the easement was acquired by the State of South Carolina. The growing realization of the importance of these marshes in estuarine productivity has generated controversy over their continued use for the disposal of dredged material. As can be seen in the conflicting recommendations for disposal by various agencies in this EIS, no one method of disposal is devoid of environmental impacts. Further, preferences for disposal methods expressed by cognizant agencies have varied from one project to another and over a period of time as new criteria are applied. Because of the wide geographical area of the subject project and the long period during which maintenance will be required, the selection process described in Section 1.04.03 is felt to be the best approach for avoiding adverse impacts as they are now anticipated and as they are more fully appreciated in the future.

1.04.02 No authority exists to require the local sponsor to obtain easements or to define alternate sites any faster than the need for these disposal areas arises. The Corps recognizes the advantages of a long-term plan to define future disposal areas, but is constrained by the lack of authority to require such a plan and several disadvantages:

(1) At any time after the adoption of such a plan, some or all of the prospective disposal sites may become developed or used for some purpose which would be incompatible with their proposed use for disposal of dredged material.

(2) To announce in advance the location of all proposed disposal sites needed over the life of the project would invite speculation and escalation of costs.

(3) If the local sponsor were to acquire disposal sites far in advance of actual need, and if the disposal of dredged material as planned were precluded by economic, ecological or any other considerations, the local sponsor would have a great deal of capital invested in uneeded property.

The Corps can reject sites proposed by the local sponsor which it considers inadequate, based on current needs and policy. The Draft EIS stated in several places the desire of the Corps to use upland disposal sites and to discontinue use of marshlands after the sites now being used are filled to capacity. "Federal Projects Involving the Disposal of Dredged Material in Navigable Waters," 39FR 26635-26641, July 22, 1974, further states the Corps' intentions to discourage the use of wetlands as future disposal sites.

1.04.03 In order to lessen any adverse effects of the disposal operation, the Charleston District will coordinate on a case by case basis all future dredging activities with the Environmental Protection Agency and other interested Federal and State agencies. This procedure is being initiated with the dredging scheduled to begin in December 1975. Interagency coordination meetings and field trips as necessary prior to the selection of disposal sites will include EPA, U. S. Fish and Wildlife Service, South Carolina Wildlife and Marine Resources, and other cognizant agencies. Conflicting interests that will bear on this coordination include: 1) the limitation imposed by available funds on maintenance dredging by the Corps of Engineers; 2) the avowed intention of the EPA to withhold approval of marsh sites for the disposal of dredged material; and, 3) the responsibility of the State to provide the additional disposal areas (presumably uplands) that might be required if the continued use of marshes is curtailed sufficiently.

The Charleston District will in the future contribute to the cost of county or state comprehensive mosquito control programs which include disposal areas that provide breeding sites for mosquitoes. The Federal cost will proportionate to the contribution of disposal areas to the mosquito problem.

1.05 Special studies.

1.05.1 The Charleston District has initiated a comprehensive study of maintenance problems of the AIWW. The general objective of this study is to arrive at recommendations for solving problems involved in the future maintenance of the AIWW. This also includes consideration of problems that might be encountered in possible increases in project dimensions. The participation of a fully informed public and public

agencies is to be an instrumental part of these recommendations. The full range of economic and environmental consequences of various alternative courses of action will be described. The main subtasks are:

(1) Identify present and future AIWW maintenance problems,
(2) Identify the full range of alternative solutions to these problems,
(3) Analyze all alternative solutions for project cost implications, required project authorization modifications, regional growth effects, and environmental effects,
(4) Identify those solutions suitable for short-range implementation and those requiring long-range consideration, and
(5) Select, from the various solutions identified, the apparent optimum solutions for recommendation.

This study effort is scheduled to take approximately three years and to be completed by the end of FY 1977.

1.05.2 A 1970 interim report on a long-range spoil disposal study by the U. S. Army Engineer District, Charleston Corps of Engineers recommended the use of a special dredge and barges to move spoil to offshore sites. This study was prepared for maintenance of Charleston Harbor, but could be applied to parts of the AIWW. As described in the report, "Maintenance of the navigation features by this plan would be in three steps as follows: (1) initial removal of the in situ shoal material by a special dredge; (2) direct pumping of the dredged material into hopper barges located along side the dredge, and (3) conveying the material to sea by barges for disposal. The following major items of equipment will be required for continuous operations: special dredge, eight barges, two tenders, and two tugs." The cost of dredging by this method was calculated in 1970 to be $0.42/C.Y. This cost was updated in "Interim Review of Reports, Charleston Harbor, South Carolina," October 1974 to $0.68/C.Y. Costs for the other seven methods of disposal studied showed a similar increase, and the offshore disposal method described above remained the most economical method of those studied. The following assumptions were made in these studies:

(1) Special dredge can handle 7,000,000 C.Y. of in situ material (equivalent to 11,600,000 C.Y. of dredged mixture) in 7,000 hours (2.8 C.Y./Min)
(2) Average density of in situ shoal material = 1300 gm/liter
(3) Average densty of dredged mixture = 1150 gm/liter
(4) Average haul distance = 17 miles (one way)
(5) Average speed of tow and barges = 5 mi/hr
(6) Dumping time of barges = 10 min

The special dredge referred to above is one which pumps shoal material with a much lower water content than conventional hydraulic dredges. This makes the conveyance of dredged material to disposal sites economical without temporary storage for drying and without consequent additional costs. The special equipment needed, although in use in Holland, is not currently available from Government plant or commercial companies. The equipment could be made available well within the project life of this plan. Diked disposal areas, upland sites or marsh building sites will be used in the interim period.

2.0 Existing environmental setting.

2.01 General. The existing project, identified by the title "Atlantic Intracoastal Waterway between Norfolk, Virginia and the St. Johns River, Florida (Charleston District)", provides a sheltered continuous route for commercial and recreational boat traffic along the eastern seaboard from Virginia to Florida. This environmental impact statement is concerned with the Charleston District section of the waterway, a 210 mile reach which traverses five coastal South Carolina counties: Horry, Georgetown, Charleston, Colleton, and Beaufort. As shown in Figure 1, Mile 342 (342 statute miles from Norfolk, Virginia) at Little River Inlet near the North Carolina-South Carolina state line is the upper limit and Mile 552 at Port Royal Sound near Beaufort, South Carolina (Figure 3) is the lower limit of Charleston District responsibility.

2.01.1 From Little River Inlet, the waterway passes through the 26 mile long Pine Island Cut and enters the Waccamaw River. It follows the Waccamaw River into Georgetown Harbor and then enters Winyah Bay. From Winyah Bay it passes through the Esterville Minim Creek Canal, Four-Mile Creek Canal, and Alligator Creek through a landcut to McClellanville. It then goes through Matthews Cut, Harbor River, Graham Creek and a long landcut to Price Creek. It then passes north of Capers Island, through Bullyard Sound, and north of Dewees and Sullivans Islands to Charleston Harbor. From Charleston Harbor the waterway goes through Wappoo Creek and Elliott Cut into the Stono River and on to the Wadmalaw River. From the Wadmalaw it passes through the Dawho River and North Creek and into the South Edisto River by way of Watts Cut. From the South Edisto River it passes through Fenwick Cut, the Ashepoo River and the Ashepoo-Coosaw Cutoff into the Coosaw River. It then passes into Brickyard Creek and on to the Beaufort River to Port Royal Sound, the end of the project within the Charleston District.

2.02 Other Federal projects. Other Federal projects traversed by the waterway are discussed below and depicted on Figure 4.

2.02.01 Little River Inlet. The Little River Inlet Navigation Project is located on the South Carolina - North Carolina State line and was authorized by Resolutions of the Senate and House Public Works Committee adopted on 12 October 1972, passed under the provisions of Section 201 of the Flood Control Act of 1965 (PL 89-298). The recommended project provides for an entrance channel 12- by 300-feet across the seaward bar, thence, a 10- by 90-foot inner channel to the AIWW. The entrance channel would be stabilized by ocean jetties extending seaward 3,200 feet and 3,000 feet on the north and south sides of the inlet, respectively. This project is now in pre-construction phase of planning.


HUNTINGTON, W VA DISTRICT
NORFOLK, VA DISTRICT
VIRGINIA
NORTH CAROLINA
BOUNDARY
NASHVILLE, TENN. DISTRICT
N
YADKIN RIVER
DISTRICT BOUNDARY
WILMINGTON, N.C DISTRICT
NORTH CAROLINA
SOUTH CAROLINA
LUMBER RIVER
LITTLE PEE DEE RIVER
GREAT PEE DEE RIVER
WATEREE RIVER
WACCAMAW RIVER
LYNCHES RIVER AND CLARK CREEK
SANTEE RIVER
CONGAREE RIVER
LITTLE RIVER INLET
MURRELLS INLET
EDISTO RIVER
GEORGETOWN HARBOR
COOPER RIVER CHARLESTON HBR
SHIPYARD RIVER
TOWN CK
SALKEHATCHIE RIVER
BERESFORD CREEK
ATLANTIC INTRACOASTAL WATERWAY BETWEEN NORFOLK VA AND THE ST JOHNS RIVER FLA (CHARLESTON DISTRICT)
ASHLEY RIVER
CHARLESTON HARBOR
SAVANNAH, GA. DISTRICT
ABBAPOOLA CREEK
ADAMS CREEK
PORT ROYAL HARBOR
VILLAGE CREEK
RUSSELL CREEK
ST HELENA SOUND
PORT ROYAL SOUND
ATLANTIC OCEAN
INDEX MAP
RIVER AND HARBOR WORKS
CHARLESTON DISTRICT
CORPS OF ENGINEERS
CHARLESTON S.C

FIGURE 4

2.02.02 Waccamaw River. The Waccamaw River Navigation Project provides for a channel 12 feet deep at mean low water from its mouth to Conway, a distance of 41.5 miles; thence 4 feet deep at mean low water to Red Bluff, 25.5 miles above Conway; thence a cleared channel to Lake Waccamaw, North Carolina. The existing project was authorized by the following River and Harbor Acts: June 14, 1880 - S. Ex. Doc. 117, 46th Congress, 2nd Session, and Annual Report, 1880, p. 848; July 3, 1930 - House Document 82, 70th Congress, 1st Session. The 12-foot channel to Conway (mile 41.5) was completed in 1924, and the 4-foot channel to Red Bluff (mile 70) in 1931.

2.02.03 Georgetown Harbor Project. The existing authorization provides for a channel 27 feet deep from that depth in the Atlantic Ocean through Winyah Bay to and including a turning basin in the Sampit River at the U. S. Highway 17 bridge south of the city. Two stone jetties, completed in 1904, stabilize the 600-foot wide channel across the entrance bar. The channel narrows to 400 feet after passing through Winyah Bay gorge and this width is maintained to the head of the project at the turning basin. A 27-foot side channel 250 feet wide leads to a turning basin at the American Cyanamid Company at the upper end of the city waterfront. An 18-foot channel is also authorized in the remainder of the Sampit River along the city waterfront and adjacent to portions of the 27-foot side channel. The existing project was authorized by the following River and Harbor Acts: Aug. 5, 1886 - H. Ex. Doc. 258, 48th Cong., 2d sess.; H. Ex. Doc. 117, 50th Cong., 2d sess.; H. Doc. 398, 58th Cong., 2d sess.; H. Doc. 211, 76th Cong., 1st sess.; June 30, 1948 - S. Doc. 21, 81st Cong., 1st sess. Construction of the project was completed in 1952.

2.02.04 Town Creek. The Town Creek project is located near the coastal town of McClellanville and is designed to improve navigation between McClellanville and the Atlantic Ocean via Town and Five Fathom Creeks. The recommended plan provides for a channel 10 feet deep at mean low water from the Atlantic Intracoastal Waterway to the mouth of Five Fathom Creek and a channel 12 feet deep at mean low water from the mouth of Five Fathom Creek to the 12-foot depth contour in the Atlantic Ocean. The project was authorized by Section 107 of the Rivers and Harbors Act of 1960, as amended, which provides for the development of small navigation projects not specifically authorized by the Congress. This project was completed in 1975.

2.02.05 Cooper River Rediversion Project. This project was authorized by the Rivers and Harbors Act of 1968 (Public Law 90-483, 90th Congress, S. 3710, 13 August 1968) and provides for the construction of a rediversion canal from the northeast portion of Lake Moultrie to the Santee River near Lake Mattasee and construction of a powerhouse,

fish lift, and fish hatchery. The rediversion canal will be about 11.5 miles in length and will consist of a 2.5 mile entrance channel in Lake Moultrie, an intake canal about 4.0 miles long and a tailrace canal about 5.0 miles long. Rediversion will decrease the average discharges through the Pinopolis Dam to about 3,000 cfs and will increase average flows in the Santee River. The purpose of the project is to "redivert" the major portion of the waters from the Santee basin from the Cooper River to the Santee River thereby effecting the reduction of harbor shoaling and related costly dredging operations in Charleston Harbor. Funds have been allocated for this project and construction will begin in the near future.

2.02.06 Charleston Harbor. The existing Charleston Harbor project, authorized by the Rivers and Harbors Act of June 18, 1878, and by subsequent acts, of which the latest were dated October 17, 1940, March 2, 1945, September 3, 1954, and July 14, 1960, provides for the following work:

A channel for commercial purposes 35 feet deep and 1,000 feet wide from the sea to the inner end of the jetties, thence 600 feet wide to the U. S. Naval Shipyard, and thence 400 feet wide to the mouth of Goose Creek, a total distance of 21.9 miles, with a turning basin 700 feet wide at the Port Terminals; and for a channel 35 feet deep and 500 feet wide through Town Creek ; for a channel in Shem Creek 10 feet deep and 110 feet wide from a flared entrance from Hog Island Channel to and including a turning basin 130 feet wide and 400 feet long with the upper end 250 feet upstream from the Mount Pleasant public wharf, thence 10 feet deep and 90 feet wide to the bridge on U. S. Highway No. 17; and for maintenance of a channel 10 feet deep and 90 feet wide in Hog Island Channel from Shem Creek to the Atlantic Intracoastal Waterway. The project also includes the maintenance of 2 entrance jetties of stone on log mattress foundation; the north jetty is 15,443 feet long, and the south jetty, 19,014 feet long; the distance between their axis at the outer end is 2,900 feet. The project also provides for the following work, which was authorized to be prosecuted only as found necessary in the interest of national defense: a 40-foot channel, 1,000 feet wide from the sea to the inner end of the jetties, thence 600 feet wide to the south pier at the Navy Yard, and then 1,000 feet wide to the Commandant's wharf; and an anchorage area 30 feet deep between Castle Pinckney and Fort Moultrie. The project has been completed except for the 40-foot, national defense project and a part of the anchorage basin.

2.02.07 Charleston Harbor Navigation Study. The Charleston Harbor Navigation Study is authorized by Section 6 of the Rivers and Harbors Act of 1945 and Seven Congressional Resolutions; the latest adopted 19 October 1967 by the Committee on Public Works of the United States House of Representatives. The study is intended to determine if the existing project should be modified in any way at this time (deepening, widening, or extending existing channels).

The recommended plan of improvement for Charleston Harbor consists of the following:

a. Deepening the existing entrance channel from a depth of 35 feet to a depth of 42 feet.
b. Deepening the existing harbor channels from a depth of 35 feet to a depth of 40 feet from the Atlantic Ocean to Mile 15.7 at Goose Creek.
c. Deepening Shipyard River channel from 30 to 38 feet and changing the alignment of the existing turning basins.
d. Enlarging the anchorage basin at the harbor mouth.
e. Enlarging the turning basin at the head of the commercial channel.
f. Dredging a new turning basin adjacent to the Columbus Street docks.
g. Shifting of channels near the various terminals to provide 125 feet between existing piers and the edge of the channel.

This project is in the pre-authorization stage of planning.

2.02.08 Ashley River. The existing project, authorized by the Rivers and Harbors Act of July 25, 1912 and August 26, 1937, provides for:

A channel 30 feet deep at mean low water and 300 feet wide from the mouth to the Standard Wharf, a distance of 7.4 miles; suitably widened at bends and at head of the improvement; and for maintenance, to a depth of 12 feet and width of 100 feet from the approach channel to the municipal yacht basin. The project was completed in 1940.

The controlling depth at mean low water in June 1975 was 15 feet for a width of 300 feet from the mouth to the downstream highway bridge; thence 14 feet to the head of the project. This project is now inactive.

2.02.09 Port Royal Sound. The Port Royal Sound Navigation Project provides for a channel from the ocean through Port Royal Sound to Port Royal, South Carolina, 27 feet deep and 500 feet wide across the ocean bar and in Port Royal Sound for approximately 13.2 miles, thence 24 feet deep and 300 feet wide in Beaufort River and Battery Creek for approximately 7.5 miles to and including a turning basin 27 feet deep and 600 feet wide opposite the wharf of the South Carolina State Ports Authority. The existing project was authorized by the Rivers and Harbors Act approved September 3, 1954, in accordance with plans contained in House Document 469, 81st Congress, 2nd Session. That portion of the project providing for a 24-foot channel and 27-foot turning basin at the head of the project was completed in June 1956. The rest of the project was completed in May 1959.

2.03 Anchorage and Wharves. Anchorage space is available in the bends of the old river channel at and near the town of Little River, in Waccamaw River except in the narrowest reaches, in Winyah Bay and Charleston Harbor, and in many of the numerous connecting natural channels from Winyah Bay to Beaufort. Dockage is available at Little River, Georgetown, Charleston, and Beaufort, and to a more limited extent at Bucksport, McClellanville and Yonges Island. Many privately owned basins are located on the seaward side of the waterway between Little River and Winyah Bay. Docking and fueling facilities, provisions, and marina supplies are also available at several locations along the waterway. There is a county-owned yacht basin on the seaward side of the waterway just south of the highway bridge at Socastee, Mile 371, however, no wharves have been constructed to date in this basin. At Charleston, on the Ashley River waterfront, there is a city-owned marina where provisions, fueling and docking facilities, and marine supplies are available. Government-owned tie-up dolphins have been constructed on each side of the Ben Sawyer Bridge at Sullivans Island, Wappoo Creek Bridge at James Island, and the North Seaboard Coast Line Railroad bridge at Johns Island.

2.04 Geology. That part of South Carolina through which the AIWW passes is in the broad geologic province called the Coastal Plain. The geologic history of the Coastal Plain of South Carolina has been marked by uplift and erosion of the land; a rise and fall of the sea. Obscured by surface sands, the underlying rock formations consist of sands, clays, marls, and limestones formed by sedimentation in shallow marine environments. The basal stratum overlying older crystalline rocks is the Tuscaloosa formation which is continental in origin, depauperate in fossils, probably of late Cretaceous age,

with a northeast to southwest strike, and southeast dip. It is mainly composed of sands and clays. The sands consist of angular grains that are fine to coarse in texture and often contain a large percentage of pure white kaolin. The clays are more or less arenaceous, and fine muscovite mica is everywhere present in varying amounts. Near the end of Tuscaloosa time the Coastal Plain was slightly raised and the streams began to erode the top of the Tuscaloosa formation, leaving an irregular surface on which the younger Black Creek formation was deposited unconformably.

2.04.01 The Black Creek formation consists of beds of gray to black clays and thin beds of gray to white slightly glauconitic sand. The Black Creek formation was deposited in palustrine, estuarine, beach, and very shallow neritic environments along a low, flat shifting littoral zone. Carbonized wood fragments and pyrite are common in the characteristically gray to black sediments. The clays are generally dark gray or black due to the presence of organic matter, or white and non-calcareous. Similar to the Tuscaloosa formation, the Black Creek formation strikes northeast to southwest and dips slightly to the southeast. It is overlain by the Peedee formation.

2.04.02 First described from outcrops along the Pee Dee River in Florence County, the Peedee formation was deposited under shallow to moderately deep marine shelf conditions and is considered to be the last of the Cretaceous Period sediments. This formation consists chiefly of dark green or gray, glauconitic and argillaceous sands and impure limestones. The sands contain much fine mica and are often calcareous. Varying amounts of dark marine clay are interbedded with the sands and the materials as a whole, although not truly consolidated, are quite compact. Fossil shells and shell fragments, principally mollusks, are present at places as layers one to five feet thick and often constitute true shell marl beds. Shark teeth are not uncommon and fragments of bones occur occasionally. Wells drilled in the vicinity of Southport, North Carolina indicate a thickness of the Peedee formation in excess of 800 feet. The strike of the formation is northeast to southwest and the southeasterly dip is at the rate of 20-25 feet per mile.

2.04.03 The basal Tertiary formation has been named the Black Mingo from deposits occurring in the vicinity of Black Mingo Creek in Georgetown County. Along the inner coastal plain there is little apparent break between the deposits of Cretaceous and Tertiary age. Seaward, however, the Black Mingo formation is more distinct, composed of greenish gray sand and beds of opal claystone, which differ in color, texture, and fossil content from the underlying Peedee formation.

The environment of deposition is thought to be a large bay or marine sea in which silica was quite abundant. The outcrop area of the Black Mingo formation includes the western half of Georgetown County and stretches inland to the inner coastal plain. Strike and dip is similar to that of the underlying formations.

2.04.04 In northeastern South Carolina, the Middle and Upper Eocene deposits are represented by the Santee and Castle Hayne limestones. The Santee limestone is nearly pure white to creamy yellow, fossiliferous, and partly glauconitic. It is a moderately good acquifer and is one of the principal sources of water for domestic use in the Georgetown area. The Castle Hayne limestone, previously thought to be restricted to southeastern North Carolina has recently been found to be stratigraphically more widespread but the extent of the formation and the dip is yet to be determined in coastal South Carolina. It is a buff gray limestone, varying from hard to crumbly, and contains many fossils.

2.04.05 South of the Santee River, a calcareous bed of Oligocene age occurs, referred to as the Cooper marl, and presently known to be about 200 feet thick. It is a finely granular olive-drab to brownish marl containing glauconite and foraminifera and characterized by phosphatic nodules in the lower part. Future investigation may show that it extends north of the Santee River into Georgetown County.

2.04.06 Sediments of Miocene age have been designated the Hawthorn and Duplin formations. The Hawthorn is usually mapped as occurring in the southern coastal plain of South Carolina and the Duplin formation in the north central coastal plain. The Hawthorn is a sandy phosphatic marl, soft limestone, and/or hard brittle shale, containing few fossils. It is also characterized as having a low permeability, but does supply some water for domestic use. The Duplin formation is a sandy shell marl, less than 50 feet thick in South Carolina and outcropping in isolated patches.

2.04.07 Pliocene sediments are found in the Waccamaw formation, which occurs as outcrops along the Waccamaw River and as a broad belt parallel to the coast, extending from the North Carolina line through Horry and part of Georgetown Counties. The formation consists of blue gray, yellow, and brown sandy marl estimated to be about 35 feet thick. It has a diverse fossil assemblage.

2.04.08 The surface deposits of Pleistocene and recent geologic age collectively form the terrace sediment complexes. These unconsolidated sediments of sand, clay and shell were deposited during sea level fluctuation in response to continental glaciation. These deposits serve to obscure the outcrops of the underlying Cretaceous and Tertiary beds and make up most of the area through which the AIWW was actually excavated.

2.04.09 Mineral Resources. Mineral resources along the coast which are of possible economic interest include: clay, sand and gravel, heavy minerals, coquina, marl, limestone, phosphate deposits, mica, peat, oil, and gas.

2.04.09.1 Extensive clay deposits occur in marsh areas and can be used for brick manufacture and probably in the manufacture of lightweight aggregate. The commercial potential of these clay deposits is speculative at present.

2.04.09.2 Sand and gravel resources are not being commercially developed in the tidelands at the present time, however, their importance may increase in the future. Heavy minerals are not currently being mined along the coast nor is there any indication that they will be.

2.04.09.3 Coquina is used in some coastal areas for road material and general fill purposes. In 1970, most coquina production came from reworking piles of dredged material along the AIWW in Horry County.

2.04.09.4 Marl is a soft, clay-like limestone which has been used in the past as a soil conditioner and mild fertilizer for lean, acid soils. Exploitation of this resource is speculative at present.

2.04.09.5 Limestone occurs at shallow depths in tidelands areas of Beaufort and Colleton Counties, commercial exploitation of limestone deposits is speculative at this time.

2.04.09.6 Phosphate deposits are known to occur along the coast in Charleston, Beaufort, Colleton and Jasper County. These deposits are not commercially important at present.

2.04.09.7 Oil and gas potentials of the South Carolina coast are highly speculative at present although oil and gas deposits probably occur somewhere on the Continental Shelf off the Carolinas.

2.05 Soils. The discussion that follows is based on information contained in "General Soils Maps of South Carolina Counties, Soil Association Description" by G. R. Craddock and C. M. Ellerbe.

2.05.01 Beaufort County

a. Kiawah-Wando-Seabrook Association: Nearly level, somewhat poorly to well drained soils with loamy fine sand surface soils and subsoils. The larger portion of the soils on the Carolina Sea Islands belong to this association.

b. Ona-St. Johns Association: Nearly level, poorly to somewhat poorly drained sands with organic stained layers or weakly cemented organic hardpans. This association is found on some coastal islands but is primarily found on broad, level areas in the vicinity of Bluffton, South Carolina.

c. Tidal Marsh Association: Firm to soft tidal marsh. This association is found along the numerous tidal streams and on broad flat areas in the southeastern part of the county. Soil materials in this association are unclassified consisting primarily marine of sediments. They are predominately mineral soil materials with varying amounts of organic matter.

2.05.02 Charleston County

a. Tidal Marsh Association: Wet peats, mucks and loams flooded by tide water. This is a level poorly drained plain which extends the length of the seaward side and inland along the tidal streams and rivers of the county.

b. Wando-Seabrook Association: Excessively drained to moderately well drained, nearly level to gently sloping, deep loamy sands. This association is found roughly parallel to the coastline and consists of high, broad ridges and slightly lower lying bands of sandy soils.

c. Kiawah-Seabrook-Rutlege, thick surface Association: Moderately well drained to poorly drained, nearly level to depressional loamy sands. This association consists of low, broad ridges and long, narrow to broad depressions roughly parallel to the coastline.

d. Scranton-Klej-Rutlege Association: Somewhat poorly drained to poorly drained, nearly level sands having a dark colored layer in the subsoil. This association consists of low, narrow and broad ridges and long narrow troughs roughly parallel to the coastline.

e. St. Johns-Ona Association: Very poorly drained to somewhat poorly drained, level to nearly level sands with organic hardpan or stained layers. This association consists of low, broad ridges and narrow to broad, level areas roughly parallel to the coastline.

2.05.03 Colleton County

a. Bladen-Weston-Eulonia Association: Moderately deep, moderately well drained to poorly drained soils with sandy clay loam to clay subsoils. This association is on level to gently sloping areas in the southern portion of the county and the soils have developed in thick beds of Coastal Plain sands and clays.

b. Kiawah-Wando-Seabrook Association: Deep to moderately deep, excessively drained to poorly drained sandy soils on level to very gentle slopes. This association is on broad, level areas in the southeastern portion of the county and soils have developed in thick beds of Coastal Plain deposits.

c. Marsh Association: Firm to soft tidal marsh. This association is on broad, flat areas in the southeastern section of the county along the major streams. The soils have developed in marine or stream sediments of mixed alluvium. Only a small percent of these marshes is classified as organic soils and the mineral soils vary from sands to clays.

2.05.04 Georgetown County

a. Capers Association: Deep, very poorly drained, nearly level soils on tidal flats and estuaries. Capers soils have silt loam to clay surface layers and silt clay loam to clay subsoils. These soils contain a high percentage of organic material.

b. Leon-Rutlege Association: Deep, somewhat poorly and very poorly drained, nearly level soils which have developed from moderately thick beds of sand. This association consists of broad, nearly level areas in the eastern section of the county.

c. Wando-Coastal Beach Association: Deep, excessively to well drained gently sloping to nearly level soils which have developed in thick beds of sand. This association is in the eastern section of the county between the Waccamaw River and the Atlantic Ocean. The sand dunes and beaches bordering the Atlantic Ocean are also part of this association.

d. Chastain-Chewacla Association: Deep, poorly and somewhat poorly drained, nearly level soils on stream floodplains. This association consists of the floodplains along the Santee, Waccamaw, and Great Pee Dee Rivers. These soils are mixtures of clay, loam, silt loam, and silty clay loam.

e. Kershaw-Rutlege Association: Deep excessively and very poorly drained, sloping and nearly level sandy soils. This association makes up Sandy Island located in the northeast section of the county between the Waccamaw and Pee Dee Rivers.

f. Lynchburg-Coxville Association: Deep, somewhat poorly and poorly drained nearly level soils. Except for a small area along the AIWW in the northeast part of the county near Murrells Inlet, this association occurs in the central portion of the county and is composed of sandy loam, loam, clay loam and sandy clay subsoils.

g. Troup-Wagram-Rutlege Association: Deep, well drained and very poorly drained, gently sloping and nearly level soils. This association is found west of Carver's Bay and Gapway Bay and south of the city of Georgetown. Soils in this association are sandy, sandy loams, and sandy clay loams.

h. Lakeland-Chipley Association: Deep, excessively and moderately well drained, gently sloping and nearly level soils. This association is scattered throughout the county and its soils have developed in thick beds of coastal plain sands.

2.05.05 Horry County

a. Wando-Coastal Beach Association: Excessively drained nearly level sandy soils. This association borders the Atlantic Ocean and consists of broad, nearly level areas, sand dunes, and coastal beaches.

b. Bladen-Weston Association: Poorly drained sandy loam soils on broad nearly level areas in the southeastern section of the county. These soils have developed from thick beds of clays and heavy sandy clays.

c. Swamp Association: Very poorly drained, swampy land subject to frequent overflow, intermixed with somewhat poorly drained low terrace soils. This association consists of flat swampy lands along the Little Pee Dee and Waccamaw Rivers and Kingston Lake Swamp. Swamp soils are composed of organic layers of verying thickness over mixed alluvium of Coastal Plain sediments.

d. Chewacla-Wehadkee Association: Somewhat poorly drained to very poorly drained, nearly level soils on the floodplain of the Great Pee Dee River in the southwestern corner of the county. Soils have developed from sediments eroded from upland soils of the Piedmont Plateau and are mostly silty clay loam and clay loam.

e. St. Johns-Leon-Rutlege Association: Very poorly drained to somewhat poorly drained nearly level sandy soils with organic stained or weakly cemented layers. The association is characterized by a series of crescent-shaped low ridges parallel to the Atlantic Ocean.

f. Goldsboro-Scanton-Chipley Association: Moderately well drained to somewhat poorly drained, nearly level soils. This association is found along the waterway near Little River and has loamy sand, sand, sandy clay loam soils.

2.06 Hydrology.

2.06.01 Ground Water. In the coastal areas of South Carolina, fairly abundant quantities of ground water of good quality are available from water table aquifers of Pleistocene to Recent age and artesian aquifers of Pliocene(?) to Early(?) cretaceous age (S. C. Water Resources Commission, 1970).

2.06.01.1 Water Table Aquifers. Water table aquifers consist of fine to medium grained quartz sand and in some of the lower coastal areas, shell hash or coquina occurring at depths of 25 to 90 feet. Wells developed in these aquifers generally yield 100 or more gallons per minute (gpm). The quality of this water is acceptable for many purposes but in some areas may be brackish or have an objectionable odor caused by decayed organic material and/or hydrogen sulfide gas (H_2S).

2.06.01.2 Deep aquifers. The deeper (100-2,800 feet) aquifers consist of fine to coarse glauconitic, phosphatic sands of Early(?) to Late Cretaceous age (Pee Dee, Black Creek, Tuscaloosa and Atkinson Formations, or other unnamed units of Late(?) Cretaceous age) and some younger deposits of Early Tertiary age (Midway equivalent, Black Mingo Formation, Congaree Formation, or its equivalent - the Santee Limestone, Castle Hayne Limestone, Ocala Limestone, Tampa (?) Limestone, Duplin Formation, and the Waccamaw Formation). The major aquifers of the coastal plain are generally grouped into two principal units - those deposits of Tertiary age and those of Cretaceous age.

2.06.01.2.1 Tertiary Deposits. Tertiary deposits include the clastics of Paleocene to Eocene age (and less definitely those of Miocene age), including the Santee and Castle Hayne Limestone and the Midway or Black Mingo sands. Of these, the highest yields are developed from wells in the Eocene limestones from which as much as 2,200 gpm can be obtained from a single well.

2.06.01.2.1.1 Waters from the shallower Tertiary sand aquifers are generally soft, low in dissolved-solids content, acidic and may be high in dissolved iron or carbon dioxide gas (CO_2). Waters from the limestone or calcareous sand aquifers are moderately hard to very hard, 61 to 250+ mg/l (milligrams per liter) of total hardness as CaC03, and have moderate concentrations of dissolved solids (150 to 500 mg/l). In places this water is high in dissolved iron (up to 2.0 mg/l) or has objectionable amounts of hydrogen sulfide gas (H2S).

2.06.01.2.2 Cretaceous Deposits. Deposits of Cretaceous age include the clastics of Late Cretaceous and possibly Early(?) Cretaceous age. Maximum water yields from wells developed in these aquifers probably approximate 1,000 gpm.

2.06.01.2.2.1 Waters from the deeper (500 to 2,800 feet) sand aquifers of Cretaceous age are typically a sodium bicarbonate type, very soft, high in bicarbonate, fluoride (as much as 7.0 mg/l) and dissolved solids content (up to 2,000 mg/l). These waters are generally basic with a pH of 8.0 or higher; they might also have a high chloride content, depending upon their location and depth.

2.06.01.3 Salt-water intrusion. Salt-water intrusion of aquifers in coastal South Carolina has taken place in past geologic time and is continuing at the present time. Encroachment is considered most serious in Tertiary aquifers on the southern coast in limestone and sand aquifers 100 to 800 feet deep and in Cretaceous aquifers at depths of 1,300 to 2,000 feet. Other areas which potentially could become subject to salt-water intrusion if the Cretaceous sand aquifers are pumped excessively or wells are drilled beyond the known fresh water-salt water interface include the Grand Strand area between Myrtle Beach and Little River and the Georgetown area.

2.06.01.4 Water Supply and Use. According to the 1970 Tidelands Report (S. C. Water Resources Commission, 1970), there are approximately 60 public water supplies in the eight coastal counties covered by this report. These supplies provide water for approximately 400,000 persons or 72% of the total coastal county population of 554,300. Ground water is the source for 56 systems serving 84,000 persons and surface water supplies four systems and about 316,600 persons. The remaining population of the coastal counties (154,300) obtains water for domestic purposes from individual wells. The total capacity of the water systems utilizing ground water in 1970 was 42.9 million gallons per day(mgd) with an average daily use of about 12.9 million gallons. The total capacity of the surface water systems in 54.3 mgd, with an average daily use of about 40 million gallons.

2.06.02 Tidal Hydrology. The mean range of tides varies considerably as one travels between the north and south ends of the waterway (see Table 4). For example, the mean range of tide at the town of Little River is 5.2 feet; at Winyah Bay 3.3 feet; at North Santee River 4.5 feet and thence to Charleston Harbor 5.2 feet; at Church Flats, Stono River 5.7 feet; at Yonges Island 6.6 feet; at South Edisto end of Watts Cut 6.3 feet; at Beaufort, South Carolina 7.4 feet; and at Hilton Head, Port Royal Sound 6.6 feet. Freshets in the Waccamaw and Pee Dee Rivers cause high stages along the Little River - Winyah Bay section of the waterway from Enterprise, MILE 375.0 to Brookgreen Creek, MILE 389. Extremely low tides, due to strong northwest winds during the winter months, range as low as 1.5 feet below zero datum, except in the artificial canal from White Point Creek, MILE 353.2 to Bull Creek, MILE 381.5 in Waccamaw River. Velocities range normally up to 2.5 miles per hour although during high stages of the rivers entering and crossing the waterway, extreme velocities range as high as 4 miles per hour near the entrances and crossings. Cross tidal currents are encountered at inlets, creek junctions and crossings.

2.07 Water Quality. According to the S. C. Tidelands Report (1970), that portion of the waterway from the northern boundary at Little River to the U. S. Highway 17 bridge at Georgetown is assigned Class SA: waters suitable for shellfishing for market purposes and any other usages. Suitable also for uses requiring water of lesser quality. From Highway 17 through Georgetown Harbor and Winyah Bay the waterway is Class SC: waters suitable for crabbing, commercial fishing and any other usages except bathing or other shellfishing for market purposes. Suitable also for uses requiring water of lesser quality. From Winyah Bay to its junction with the South Santee River, the waterway is Class SB: waters suitable for bathing and any other usages except shellfishing for market purposes. Suitable also for uses requiring water of lesser quality. From the South Santee to just above Charleston Harbor the waterway is Class SA. Charleston Harbor and the waterway south to about the Limehouse bridge to Johns Island is Class SC. The remainder of the waterway, except for the Beaufort River, is Class SA. The Beaufort River is Class SB.

Table 4

Tides at Selected Stations Along the AIWW

USGS Sta. No.	Location		Mean Range (feet)	Spring Range (feet)	Mean Tide Level (feet) (Above MLW)
2509	Little River (one mile above mouth)		5.0	5.9	2.5
2511	Myrtle Beach		5.1	6.0	2.5
2513	Murrells Inlet	4.5	4.5	5.3	2.2
2514	Pawleys Island		4.8	5.6	2.4
2521	Esterville-Minim Creek Canal (Ferry)		3.3	3.9	1.6
2543	Minim Creek entrance, North Santee River		3.9	4.6	1.9
2547	Cape Romain		4.7	5.5	2.3
2553	McClellanville, Jeremy Creek		5.1	6.0	2.5
2577	Charleston (Customhouse Wharf)		5.2	6.0	2.6
2601	Wappoo Creek (highway bridge)		5.2	6.1	2.6
2627	Dawho Ferry, Dawho River		6.5	7.7	3.2
2631	Yonges Island, Wadmalaw River		6.6	7.8	3.3
2633	Ravens Point, Church Creek		7.0	8.3	3.5
2641	Watts Cut entrance, o.8 mile South of		6.3	7.4	3.1
2653	Hutchinson Island, Ashepoo River		6.3	7.4	3.1
2683	Beaufort, Beaufort River		7.4	8.7	3.7
2705	Walls Cut, Turtle Island		7.1	8.3	3.6

2.07.01 As indicated in the paragraph above, several areas in or adjacent to the AIWW are closed to shellfishing because of high levels of coliform bacteria. According to the 1970 South Carolina Tidelands Report, 49,000 acres of coastal waters are closed to shellfishing for market purposes because of prohibitive concentrations of coliform bacteria found in oysters. These areas are located primarily adjacent to densely populated areas such as Little River, Georgetown, Charleston, and Beaufort. Shellfishing areas are continuously monitored by the State of South Carolina and may be opened or closed at any time conditions warrant such action.

2.07.02 Chemical characteristics of bottom sediments. The study of the chemical characteristics of bottom sediments was conducted by the Environmental Protection Agency during March, 1971. The Charleston District obtained 23 bottom samples from sites selected by an EPA representative. The sample locations are shown on Figures 1, 2, and 3. The samples were shipped in a frozen condition to EPA where they were analyzed for volatile solids, oil and grease, organic nitrogen, total Kjeldahl nitrogen, total phosphorous, chemical oxygen demand, heavy metals, and radioactivity. The results of their analysis are presented in Table 5.

2.07.02.1 EPA's evaluation and interpretation of the data collected was furnished the Charleston District in letter report dated 29 November 1972. EPA classified all locations as clean, lightly contaminated, moderately contaminated and heavily contaminated, based on interim criteria being used at that time. They concluded that sediments, other than those classified as clean should be disposed of on upland areas above the high water mark. They classified Stations 1 thru 8, 10 thru 12, 16, 17, and 21 thru 23 as clean although Stations 10, 16, and 21 thru 23 exceeded the EPA criteria then applicable for oil and grease. Station 4 was classified as being lightly contaminated as a result of zinc levels exceeding EPA criteria used at that time. Levels of volatile solids, COD, and oil and grease exceeded the interim EPA criteria at Station 14 which was classified as being moderately contaminated. Stations 9, 13, 15, 19, and 20 were considered heavily contaminated with concentrations of volatile solids, COD, oil and grease, and zinc exceeding the interim EPA criteria. Stations 9, 13, 15, and 20 also exceeded the EPA criteria used at that time for TKN. The EPA criteria used in the evaluation and which appear in table 5 have been superseded by 40 FR 41292-41298, "Navigable Waters, Discharge of Dredged or Fill Material", September 5, 1975. The interim criteria were the best figures available when they were published, but have since been shown to be too stringent in many cases. Even those AIWW samples which exceeded the interim criteria are relatively clean. Pollutants in dredged material which are water soluble could possibly reach shallow water tables if disposal took place on upland sites. Soils would likely provide some filtering action. Most contaminants discovered were not water soluble.

TABLE 5
INTRACOASTAL WATERWAY SEDIMENTS DATA

Lab. No.	Sample No./Date Sampled	Radio-Act. pCi/gm	% Tot. Vol. Solids	COD %	TKN %	NH_3-N %	Oil & Grease %	Total P %	Pb %	Zn %	Cu %	Cr %	Merphos %	DEF %	H_g %
71-480	1		0.8	0.62	0.03	0.002	0.0055	0.02	0.0017	0.0057	0.0005	0.0014			<0.00003
71-481	2		0.6	0.64	0.01		0.0182	0.01	0.0009	0.0025	0.0004	0.0005			
71-482	3		0.9	0.79	0.01		0.0267	<0.01	0.0012	0.0015	0.0011	0.0008			
71-483	4		0.6	0.52	0.01		0.0416	<0.01	0.0005	0.0011	0.0002	0.0003			
71-484	5		1.5	1.2	0.02		0.0193	<0.01	0.0006	0.0016	0.0002	0.0009			
71-485	6		1.4	0.97	0.01		0.0466	<0.01	0.0017	0.0080	0.0005	0.0010			
71-486	7		0.7	0.71	0.01	<0.002	0.0805	<0.01	0.0005	0.0007	0.0002	0.0005			
71-487	8		0.2	0.53	0.01		0.0677	<0.01	0.0003	0.0040	0.0003	0.0006			
71-488	9		16	13.0	0.33		0.332	<0.01	0.0056	0.0279	0.0024	0.0086			
71-489	10		5.5	5.0	0.11		0.330	<0.01	0.0018	0.0037	0.0006	0.0030	<0.000001	<0.000001	
71-[illegible]	11		0.6	0.44	0.01	<0.001	0.123	0.01	0.0008	0.0009	0.0002	0.0008			
71-491	12		4.4	3.0	0.06		0.101	0.03	0.0015	0.0062	0.0009	0.0018			
71-492	13		9.2	5.6	0.14		0.234	0.05	0.0029	0.0[illegible]	0.0015	0.0064			
71-493	14		3.2	2.2	0.07		0.0564	0.05	0.0014	0.4330	0.0006	0.0020			
71-494	15		13	8.0	0.22		0.216	0.06	0.0044	0.0067	0.[illegible]	[illegible]			
71-495	16		2.1	1.7	0.06		0.523	0.04	0.0011	0.0016	0.0006	0.[illegible]			
71-496	17		2.9	1.7	0.03	0.002	0.0462	0.27	0.0007	0.0015	0.0002	0.0012			
71-497	18		12	15	0.04		0.1e10	0.08	0.0003	0.0034	0.0006	0.0019			
71-498	19		16	15	0.02		0.2030	0.07	0.0036	0.0077	0.0005	0.0045			
71-499	20		15	12	0.31		0.1780	0.04	0.0044	0.0063	0.0018	0.0062			
71-500	21		5.5	3.7	0.09		0.1630	0.01	0.0015	0.0047	0.0012	0.0031			
71-501	22		1.8	1.1	0.04	0.004	0.2460	0.11	<0.0003	0.0013	0.0004	0.0019	<0.000001	<0.000001	<0.00003
71-502	23		0.6	0.51	0.01		0.0426	<0.01	0.0004	0.0037	0.0004	0.0004			
		EPA Limits	**6.0**	**5.0**	**0.1**		**0.15**		**0.005**	**0.005**					**0.0001**

2.08 Climatology. Climate along the South Carolina coast is generally considered to be temperate except in the Hilton Head Island area where it is classed as sub-tropical. The project area characteristically has cool winters and hot, moist summers. This regime is tempered somewhat by the effect of sea temperatures and breezes in areas within a few miles of the Atlantic Ocean. The moderating effect of the sea is clearly illustrated in Charleston where the minimum city temperature may register 10 to 15 degrees higher in the winter and 3 degrees lower in the summer than the airport located some 10 miles inland.

2.08.01 The mean annual high temperature for the South Carolina coastal region is about 76 degrees and the mean annual low about 55 degrees. Temperatures along the coast seldom exceed 100 degrees and a temperature of 20 degrees or less is seldom experienced. July is the hottest month and has a monthly average temperature of about 80 degrees. January is the coldest month with an average monthly temperature of approximately 49 degrees.

2.08.02 The coastal region receives an average of 49 to 52 inches of precipitation annually, almost all of which falls as rain. The greatest monthly rainfall generally occurs in July, August and September in the Charleston area and June, July, and August in the Hilton Head area. The fall, particularly the month of November is the driest time of the year.

2.08.03 Coastal South Carolina is subject to visitation by hurricanes during the summer and fall, with hurricane visitation occurring most often in August and October. The highest recorded hurricane surge tide at Charleston was the 11.2 feet above mean low water recorded during the August 1883 hurricane. In the August 1881 hurricane, the tide elevation at Hilton Head was estimated at 16.0 feet mean sea level, the highest on record.

2.08.04 A summary of climatological data collected at Charleston and Hilton Head Island is presented in Table 6.

2.09 Biotic communities.

2.09.01 General. The term biotic community is used to designate a distinct assemblage of plants and animals. In general, biotic communities may be identified on the basis of their dominant vegetation or, in the absence of dominant vegetation, by physiography. Seventeen major biotic communities have been determined as being present within 1 to 2 miles of the project. These are:

Coastal fringe communities
- Beach
- Dune
- Maritime shrub thicket
- Maritime forest

Table 6

Climatological Data for Period of Record[1/]

Time	Normal Mean Daily Temp. F° Max.	Min.	Normal Total Precipitation(")	Prevailing Wind Direction
Charleston, South Carolina				
Period of Record (yrs)	30	30	30	14
January	61.2	38.3	2.54	SW
February	62.5	40.4	3.29	NNE
March	68.0	45.4	3.93	SSW
April	76.9	52.7	2.88	SSW
May	83.9	61.8	3.61	S
June	89.2	69.1	4.98	S
July	89.2	72.0	7.71	SW
August	88.8	70.5	6.61	SW
September	84.9	66.2	5.83	NNE
October	77.2	55.1	2.84	NNE
November	67.9	43.9	2.09	N
December	61.3	38.6	2.85	NNE
Year	75.9	54.5	49.16	NNE
Hilton Head Island, South Carolina				
Period of Record (yrs)	7	7	21	
January	59.9	38.5	3.48	W[2/]
February	64.1	43.0	3.74	W
March	66.0	45.3	4.14	W
April	76.0	55.0	2.79	S
May	82.2	62.9	4.46	SSW
June	87.2	68.6	5.65	S
July	89.1	71.9	6.26	WSW
August	89.5	71.5	9.92	S
September	84.6	68.2	3.54	NNE
October	76.6	57.3	2.69	NNE
November	69.3	47.1	2.37	NNE
December	62.0	39.6	2.89	NNE
Year	75.5	55.7	51.94	W

1/ U. S. Department of Commerce, NOAA

2/ Data from Marine Corps Air Station Records

Coastal plain communities
- Cypress swamps
- Savanna and pine flatwoods
- Oak - pine forest
- Pocosins
- Carolina Bays
- Inland marshes
- Ponds and lakes

Estuarine communities of the AIWW
- Open water
- Tidal marshes
- Tidal flats
- Dredged material islands

Other communities
- Agricultural lands
- Man-dominated communities

2.09.01.1 Each of the biotic communities described in the following section contains a description and/or list of characteristic plants and animals. References used to compile these are as follows:

Plants - Geographic range, biotic community preference, and scientific and vernacular nomenclature are based on Radford et al. 1968.

Birds - Geographic range and biotic community preference and nomenclature are based on Robbins et al. 1966 and Pough 1951.

Mammals - Geographic range, biotic community preference, and nomenclature are based on Burt and Grossenheider 1964 and Palmer 1954.

Reptiles and amphibians - Geographic range and biotic community preference are based on Conant 1958 and Carr and Goin 1955. Nomenclature is based on Conant 1958.

Fish - Geographic range and biotic community preference are based on Eddy 1957, Breder 1948 and Carr and Goin 1955. Nomenclature is based on American Fisheries Society 1970.

Invertebrates - Geographic range, biotic community preference and nomenclature are based on Morris 1951, Gosner 1971, Miner 1950, Wass et. al. 1972, and Teal and Teal 1969.

2.09.02 Coastal fringe communities. The communities within this category occur all along coastal South Carolina and are in closest proximity to that portion of the AIWW located between Winyah Bay and Charleston.

2.09.02.1 Beach. Beaches occur along the emergent shorelines that are present on the seaward side of barrier islands and portions of the mainland exposed to the open ocean along the Grand Strand. Occassionally they extend along the littoral zones of ocean inlets. Beach communities are comprised of a dry berm zone that is located beyond the high tide line, an intertidal zone that is alternately covered and exposed by tidal action, and a subtidal zone that occurs below the low tide line and extends seaward, merging with the ocean surf. Beaches, in general, are gently-sloping communities that serve as transitional areas between open water and upland terrestrial communities.

2.09.02.1.1 The beach community is a harsh environment characterized by steep gradients, and rapid changes in most of its physical environmental parameters. This is particularly true of the upper surface layers. Vascular plants are typically absent from these communities primarily because of instability of the substrata, high salinity, and extreme fluctuation of moisture. Seaweeds, and seeds of Caribbean and European plants carried by the Gulf Stream are sometimes tossed up on the beach following the passage of storms. Sediments on the beach are stratified by wind and wave energy regimes according to particle size. Sediment composition consists of coarse to fine grained quartz sands and shells and shell fragments.

2.09.02.1.2 Macro-invertebrates are the predominant faunal organisms inhabiting the beach region and most live beneath the sand surface where salinities and temperatures are more constant. A considerable portion of these organisms are filter or deposit feeders and a great diversity occurs in the intertidal zones where there is a concentration of particulate organic matter brought in by the tides or supplied by the decomposition of animals on the beach. Typical beach inhabitants are beach fleas and ghost crabs in the beach berm; Florida coquinas, mole crabs and various burrowing worms in the beach intertidal zone; and blue crabs, horseshoe crabs, sand dollars and numerous clams and gastropods in the beach subtidal areas. The beach zone is utilized by many species of shorebirds for nesting and feeding. Species commonly observed are the American oystercatcher, plovers, willet, sandpipers, lesser and greater yellowlegs, gulls, and terns. Atlantic loggerhead sea turtles utilize South Carolina beaches for nesting purposes during the summer months.

2.09.02.2 Dune. Dunes are located landward and run parallel to beach communities. They are composed of drifting sand and their height and direction of movement is determined by wind direction and intensity. Few species of plants are capable of tolerating the harsh environment of the dune community. As a result, vegetative cover is usually sparse and consists predominantly of salt-tolerant perennial grasses. Typical species include bitter panic grass, saltmeadow cordgrass, sea oats, and broomsedges. American beach grass has been successfully planted at Bulls Island and beach sites near Georgetown and Charleston. All of these plants depend on the constant influx of nutrients because leaching in the dune community is very rapid. Likewise, all of the above species derive nutrients from particulate matter attached to the sands and

precipitation. As they accumulate sand at their bases, the plants increase the vertical height of the dunes and their creeping rhizome systems act as sand binders thus stabilizing the dunes. Occasionally interspersed among the dune grasses are scattered individuals of sea rocket, sandspur, seaside croton, beach spurge, evening primrose, seaside elder, beach pea, and purple sandgrass.

2.09.02.2.1 The lack of vegetative cover and an insufficient food supply limits the dune community as important wildlife habitat. Ghost crabs, tiger beetles, dragonflies, song sparrows, Savannah sparrows, barn swallows, six-lined racerunners, eastern glass lizards and eastern slender glass lizards are characteristic faunal inhabitants. Black skimmers and species of terns occasionally utilize the dune communities for nesting purposes during the spring and summer.

2.09.02.3 Maritime shrub thicket. Shrub thickets are typically found landward of the dune communities. They may extend continuously to the edge of the tidal marshes along the backside of the barrier islands or blend into a maritime forest. As the name implies, these communities are characterized by a dense growth of low shrubs that are usually entangled with numerous vines. The community usually begins abruptly on the dune side. The first shrubs are commonly prostrate but they become progressively taller with increasing distance inland. The tops of the shrubs are often closely sheared by wind-borne salt spray and form a smooth, compact, canopy surface.

2.09.02.3.1 Substrates in these habitats consist of unconsolidated sands which are intermittently flooded in low areas and well-drained at higher elevations. Typical shrub inhabitants are wax myrtle, silverling, seaside elder, winged sumac, and yaupon. Shrub species distribution and frequency of occurrence in any given area, however, varies according to substratum moisture and degree of salt spray influence. Common vine species in these communities are Virginia creeper, poison ivy, greenbriers, and wild grapes. Few herbaceous plants are present on the ground surface due to the shading effect created by the dense shrub growth.

2.09.02.3.2 Maritime shrub thickets do not provide a significant year-round food source for wildlife and, because of this, are not heavily utilized. Animal species which may be observed in this community are as follows:

Birds

Sparrow hawk	Rufous-sided Towhee
Ground Dove	Red-winged Blackbird
Mockingbird	Boat-tailed Grackle
Robin	Fish Crow
Brown Thrasher	Indigo Bunting
Gray Catbird	American Goldfinch
Yellowthroat	Savannah Sparrow
Prairie Warbler	Field Sparrow
Palm Warbler	White-throated Sparrow
Cedar Waxwing	Swamp Sparrow
	Song Sparrow

Mammals

Eastern Cottontail	Cotton Mouse

Reptiles and Amphibians

Six-lined Racerunner	Southern Toad

2.09.02.4 Maritime forest. Maritime forests occur landward of maritime shrub communities. Trees in the maritime forest are closely spaced and usually dominated by live oak. Many shrub species occur here as well but are less densely distributed than in the shrub thicket because of shading effects produced by a continuous canopy. The maritime forest is subject to the shearing effect of wind-borne salt spray and the canopy is usually planed off. The angle of the canopy bears a direct relationship to the intensity of salt spray deposited on the growing shoots. The effects of salt spray are most dramatic on the seaward side of the forest and diminish with increasing distance inland.

2.09.02.4.1 Trees and shrubs found in these habitats, in addition to the dominant live oaks, are red bay, red cedar, cabbage palmetto, holly, loblolly pine, Spanish moss, yaupon, Darlington oak, and resurrection fern.

2.09.02.4.2 Birds are the most conspicuous faunal inhabitants of the maritime forest. This is particularly true during the spring and fall when numerous migratory species are present. Representative species found in these communities are as follows:

Birds

Sharp-shinned Hawk	White-eyed Vireo
Red-shouldered Hawk	Solitary Vireo
Mourning Dove	Red-eyed Vireo
Yellow-billed Cuckoo	Parula Warbler
Ruby-throated Hummingbird	Prairie Warbler
Yellow-bellied Sapsucker	Palm Warbler
Red-bellied Woodpecker	Ovenbird
Downy Woodpecker	Yellowthroat
Blue Jay	Baltimore Oriole
Carolina Wren	Boat-tailed Grackle
Mockingbird	Cardinal
Gray Catbird	Indigo Bunting
Brown Thrasher	Rufus-sided Towhee
Robin	White-throated Sparrow
Hermit Thrush	Cedar Waxwing
Ruby-crowned Kinglet	

Mammals

Virginia Opossum	Cotton Mouse
Eastern Mole	Bobcat
Gray Squirrel	Southern Flying Squirrel
Raccoon	

Reptiles and Amphibians

Eastern Box Turtle
Green Anole
Eastern Glass Lizard
Southeastern Five-lined Skink
Eastern Coachwhip
Rough Green Snake
Yellow Rat Snake
Southern Toad
Eastern Spadefoot
Oak Toad
Green Treefrog
Squirrel Treefrog

2.09.03 Coastal plain communities. The communities included in this category are those that occur on the coastal mainland either along or a short distance inland from the AIWW.

2.09.03.1 Cypress swamps. Cypress swamps are scattered throughout the area adjacent to the waterway, especially along freshwater tributaries, around freshwater ponds, in depressions between former beach dunes and in low depressional areas within pocosin communities. Cypress swamps are found on both sides of the waterway in much of the Waccamaw River section. Bald cypress and tupelo gum are generally the dominant tree species found in this association. Bald cypress occurs as dominant on the wettest sites with the longest hydroperiod whereas tupelo gum becomes more abundant on sites with shorter hydroperiods. Other tree species found in these associations are red maples, black gum, pond cypress, sweetgum, water oak, and water ash. Near the fringes of the cypress swamp community there is a very thick shrub ecotone which contains species found in coastal plain shrub bogs. Small trees include red bay and sweet bay and the shrubs fetterbush, wax myrtle, bitter gallberry, titi, sweet pepperbush, highbush blueberry, and the evergreen vine catbrier.

2.09.03.1.1 Cypress swamps are typically rich in animal life. Of all the wooded communities along the waterway, these will generally have the greatest diversity. The following are some of the more common animals found in these habitats:

Birds

Wood Duck
Red-shouldered Hawk
Ruby-throated Hummingbird
Pileated Woodpecker
Red-bellied Woodpecker
Yellow-bellied Sapsucker
Great Crested Flycatcher
Blue Jay
Tufted Titmouse
Carolina Chickadee
Carolina Wren
Robin
Hermit Thrush
Blue-gray Gnatcatcher
White-eyed Vireo
Red-eyed Vireo
Yellow-throated Vireo
Prothonotary Warbler
Swainson's Warbler
Yellow-throated Warbler
Hooded Warbler
Prairie Warbler
Yellowthroat
Rusty Blackbird
Summer Tanager
Cardinal
White-throated Sparrow

Mammals

Virginia Opossum	Eastern Gray Squirrel
Short-tailed Shrew	Bobcat
Golden Mouse	River Otter
Marsh Rabbit	Raccoon
Cotton Mouse	White-tailed Deer

Reptiles and Amphibians

Eastern Box Turtle	Southern Copperhead
Yellow-bellied Turtle	Eastern Cottonmouth
Eastern Mud Turtle	Canebrake Rattlesnake
Brown Water Snake	Southern Dusky Salamander
Banded Water Snake	Slimy Salamander
Red-bellied Water Snake	Many-lined Salamander
Southern Ringneck Snake	Southern Cricket Frog
Eastern Mud Snake	Green Treefrog
Rainbow Snake	Northern Spring Peeper
Yellow Rat Snake	Eastern Gray Treefrog
Eastern Kingsnake	Barking Treefrog
Eastern Garter Snake	Eastern Narrow-mouthed Toad
Eastern Ribbon Snake	Southern Leopard Frog
Carolina Black Swamp Snake	Squirrel Treefrog

2.09.03.2 Savannah and pine flatwoods. Savannah and pine flatwoods communities may occur a short distance inland from the AIWW or directly border it along landcuts. These communities are areas of grassland with scattered trees and shrubs of variable density.

2.09.03.2.1 Longleaf pine and pond pine are common on both, but the latter is found more often on wetter sites and the former on sandier soil of the ridges. A third pine, loblolly, often grows where substrate moisture regimes are intermediate between these extremes. Beneath the pines occurs a sparse shrub understory containing red bay, sweet bay, titi, fetter-bush, sweet gallberry, dahoon holly, and pepperbush. The ground surface is occupied by a dense and highly diverse herbacious zone. Wiregrass dominates sandy soils while grass species of Muhlenbergia and toothache grass are more common on the clays. Other important herbs include pitcher plants, venus fly trap, panic grass, meadow beauty, fleabane, butterworts, and many others.

2.09.03.2.2 The abundant growth of grasses and forbs provides a good source of food and cover for wildlife. Herbivorous and insectivorous animals are common in these communities. Representative species include:

Birds

Sparrow Hawk	Carolina Checkadee
Red-tailed Hawk	Brown-headed Nuthatch
Bobwhite	Mockingbird
American Woodcock	Eastern Bluebird

Birds (cont.)

Common Snipe
Screech Owl
Common Flicker
Red-headed Woodpecker
Eastern Kingbird
Eastern Phoebe
Blue Jay
Common Crow
Fish Crow
Bachman's Sparrow
Loggerhead Shrike
Pine Warbler
Prairie Warbler
Yellowthroat
Cardinal
Eastern Meadowlark
Rufous-sided Towhee
Grasshopper Sparrow
Vesper Sparrow
Field Sparrow

Mammals

Least Shrew
Eastern Cottontail
Cotton Rat
Eastern Harvest Mouse
House Mouse
White-tailed Deer

Reptiles and Amphibians

Eastern Box Turtle
Eastern Garter Snake
Eastern Ribbon Snake
Northern Brown Snake
Southern Copperhead
Canebrake Rattlesnake
Eastern Diamondback Rattlesnake
Scarlet Kingsnake
Corn Snake
Ornate Chorus Frog
Southern Chorus Frog
Southern Cricket Frog
Brimley's Chorus Frog
Eastern Narrow-mouthed Toad
Carpenter Frog

2.09.03.3 Oak-pine forest. The oak-pine forest communities occupy the higher sites and usually are found a short distance inland of the waterway. Soils in these areas are excessively well drained and are subject to severe leaching. A thin layer of leaves, pine needles and cones is often intermittently present on the ground surface.

2.09.03.3.1 Longleaf pine is the dominant tree species in these communities. The pines usually occur as widely spaced individuals and thus seldom form a closed upper tree canopy. The short tree or shrub region beneath the pines is dominated by turkey oak. Like the pines, these trees seldom occur in a dense, closely spaced stand. Often present to a lesser extent in this zone are scrubby post oak, blackjack oak, and dwarf wax myrtle. The understory of the oak-pine forest includes such species as wild black cherry, sassafras, persimmon, wax myrtle, various blueberries, laurel cherry, and herbs such as wiregrass, broomsedge, goldenrod, aster, partridge berry, Spanish moss, mistletoe, poison ivy, and catbrier.

2.09.03.3.2 Animal species commonly found in this community include:

Birds

Cooper's Hawk
Red-tailed Hawk
Turkey Vulture
Black Vulture
Bobwhite
Mourning Dove
Screech Owl
Chuck-will's Widow
Common Flicker
Red-headed Woodpecker
Eastern Kingbird
Eastern Phoebe
Blue Jay
Common Crow
Fish Crow
Carolina Chickadee
Brown-headed Nuthatch
Mockingbird
Eastern Bluebird
Loggerhead Shrike
Pine Warbler
Yellow-throated Warbler
Summer Tanager
Rufous-sided Towhee

Mammals

Virginia Opossum
Least Shrew
Eastern Mole
Eastern Cottontail
Southern Flying Squirrel
Raccoon
Eastern Gray Squirrel
Eastern Fox Squirrel
Gray Fox
Striped Skunk
White-tailed Deer

Reptiles and Amphibians

Northern Fence Lizard
Six-lined Racerunner
Southeastern Five-lined Skink
Eastern Slender Glass Lizard
Eastern Hognose Snake
Eastern Coachwhip
Southeastern Crowned Snake
Eastern Diamondback Rattlesnake
Southern Toad
Oak Toad
Pine Woods Treefrog
Barking Treefrog
Carolina Gopher Frog

2.09.03.4 Pocosins. Pocosins are evergreen shrub bogs occupying slightly depressed, poorly drained areas. They develop on highly organic soils which are frequently waterlogged for long periods but are infrequently covered with water. The soil consists of a layer of organic matter or peat overlying mineral soil. Burns are frequent but as long as the fire burns only the upper layers of peat the bog will regenerate itself from sprouts. If burning is frequent enough to destroy the peat layer, the pocosin may change to a grass-sedge bog. Although "Carolina bays" are physiographically different, some are floristically similar to pocosins.

2.09.03.4.1 Many plants which inhabit pocosins are adapted to substrates with low nutrients and pH. Pond pine is the dominant tree species but seldom forms a closed canopy. A dense shrub layer is usually present beneath the pines and most species are characteristically evergreens. Species include honey cup, bamboo briar, cane, inkberry, sweet gallberry, leather-leaf, titi, wax myrtle, Leucothoe, maleberry, Virginia willow, loblolly bay, sweet bay, red bay, pond pine, peat moss, cinnamon fern, and fetterbush.

2.09.03.4.2 These densely vegetated communities are not generally inhabited by a large variety of animals, although they do serve as an area of shelter or refuge for many animals living in the surrounding area. Species commonly found in these habitats are:

Birds

Carolina Wren
Winter Wren
Robin
White-eyed Vireo
Catbird
Hermit Thrush
Cardinal
Yellowthroat
Yellow-breasted Chat
White-throated Sparrow
Song Sparrow

Mammals

Short-tailed Shrew
Golden Deermouse
Cotton Deermouse
Marsh Rabbit
White-tailed Deer

Reptiles and Amphibians

Yellow Rat Snake
Rough Green Snake
Canebrake Rattlesnake
Green Anole
Scarlet Kingsnake
Corn Snake
Southern Cricket Frog
Barking Treefrog
Pine Woods Treefrog
Squirrel Treefrog
Green Treefrog
Eastern Narrow-mouthed Toad

2.09.03.5 Carolina bays. Within the coastal plain of the two Carolinas and Georgia are thousands of physiographic features known as "Carolina Bays", the origin of which is not known. Carolina Bays characteristically are elliptical or oval in shape, have their long axis oriented in a northwest-southeast direction, and have a sand ridge along their southeast side. These bays vary in depth from a few to many feet and in length from a few hundred feet to about seven miles. Most of them are filled with peat and most drain poorly; some are filled with water and are referred to as lakes. The vegetation of these bays varies from swamp trees to dense thickets of evergreen shrubs. Plant species commonly associated with these bays include sweet bay, wax myrtle, gallberry, loblolly bay, fetter-bush, sweet gallberry, pond pine, turkey oak, and peat moss.

2.09.03.5.1 Carolina Bays are generally sparsely populated with animals especially those bays vegetated with dense thickets of shrubs. They do, however, provide an area of shelter or refuge for animals living in surrounding areas. Species commonly found in these habitats include:

Birds

Winter Wren
Carolina Wren
Robin
White-eyed Vireo
Catbird
Hermit Thrush
Cardinal
Yellowthroat
Yellow-breasted Chat
Song Sparrow
White-throated Sparrow

Mammals

Short-tailed Shrew	Marsh Rabbit
Golden Deermouse	White-tailed Deer
Cotton Deermouse	

Reptiles and Amphibians

Yellow Rat Snake	Southern Cricket Frog
Rough Green Snake	Barking Treefrog
Canebrake Rattlesnake	Pinewoods Treefrog
Green Anole	Squirrel Treefrog
Scarlet Kingsnake	Green Treefrog
Corn Snake	Eastern Narrow-mouthed Toad

2.09.03.6 Inland marshes. Inland marshes occur in low, poorly-drained areas and along the shallow water margins of ponds and lakes. Standing water is present throughout the growing season and vegetational growth is dense and often dominated by emergent herbaceous grasses, rushes, and sedges. Species composition varies depending on salinity of water. In freshwater situations species include maidencane, carexes, sawgrass, big cordgrass, spikerushes, threesquares, smartweeds, cattails, arrowheads, pickerelweed, lizard's tail, pennywort, and wild rice. In brackish situations, saltmeadow cordgrass, saltgrass, black needlerush, and marsh-fleabanes are often common.

2.09.03.6.1 Substrates in the marshes generally consist of soft muck which is rich in partially decomposed organic matter and mixed with mineral soils. Inland marshes serve many of the same ecological functions as tidal marshes and are a source of valuable nutrients and detritus, much of which is either consumed *in situ* by small animals, or is eventually washed into deeper water where it contributes to the food supply of larger pelagic and benthic animals. These communities are often closely associated with the swamp forests, and like the forests are rich in animal life. Characteristic species include:

Birds

American Bittern	Marsh Hawk
Least Bittern	American Woodcock
Great Blue Heron	Common Snipe
Common Egret	Spotted Sandpiper
Green Heron	Virginia Rail
Black-crowned Night Heron	Sora
Little Blue Heron	Greater Yellowlegs
Glossy Ibis	Lesser Yellowlegs
White Ibis	Solitary Sandpiper
American Widgeon	Long-billed Marsh Wren
Gadwall	Short-billed Marsh Wren
Green-winged Teal	Boat-tailed Grackle
Blue-winged Teal	Red-winged Blackbird
Mallard	Yellowthroat
Black Duck	Sharp-tailed Sparrow
Pintail	Swamp Sparrow
Shoveler	Song Sparrow

Mammals

Marsh Rabbit	River Otter
Rice Rat	Raccoon
Muskrat	Mink

Reptiles and Amphibians

Eastern Mud Turtle	Carolina Black Swamp Snake
Yellow-bellied Turtle	Eastern Cottonmouth
Spotted Turtle	Canebrake Rattlesnake
Banded Water Snake	Southern Cricket Frog
Eastern Garter Snake	Ornate Chorus Frog
Eastern Ribbon Snake	Southern Chorus Frog
Red-bellied Water Snake	Brimley's Chorus Frog
Brown Water Snake	Carpenter Frog
Eastern Mud Snake	Southern Leopard Frog
Rainbow Snake	Bronze Frog

2.09.03.7 Lakes and ponds. These biotic communities occur a short distance from the waterway at several locations. Lakes and ponds occur in low, depressional areas where the water table reaches the surface or where the ground substrate is underlain by impermeable materials. In general, ponds are shallow enough to permit growth of rooted plants over most of their bottoms and may dry up during periods of drought whereas lakes are filled with water throughout the year and have a central deep area that is usually devoid of rooted vegetation. Salinities in these water bodies range from fresh to brackish.

2.09.03.7.1 The vascular flora present in ponds and lakes is generally divided into three zones: Submerged, floating, and emergent. Submerged plants include bladderworts, waterweeds, water-nymph, pondweeds and egeria in fresh water to slightly brackish situations. Floating plants include white waterlily, spatterdock, water shield, duckweeds and alligatorweed. The emergent zone is dominated by rushes, sedges, and grasses previously described in the discussion in inland marshes.

2.09.03.7.2 The presence of water and abundant plant growth in many of the ponds and lakes along the AIWW provides attractive habitat for a variety of fish, waterfowl, and other aquatic and semi-aquatic vertebrate species. Characteristic inhabitants are:

Birds

Pied-billed Grebe	Shoveler
American Widgeon	Ring-necked Duck
Gadwall	Lesser Scaup
Green-winged Teal	Bufflehead
Blue-winged Teal	Ruddy Duck
Mallard	Hooded Merganser
Black Duck	Osprey
Pintail	Ring-billed Gull
American Coot	Belted Kingfisher

Mammals

River Otter	Muskrat

Reptiles and Amphibians

Common Snapping Turtle	Greater Siren
Yellow-bellied Turtle	Two-toed Amphiuma
Brown Water Snake	Broken Striped Newt
Red-bellied Water Snake	Many-lined Salamander
Banded Water Snake	Southern Leopard Frog
Eastern Mud Snake	Bronze Frog
Rainbow Snake	Bullfrog
Eastern Cottonmouth	

Fish

Bowfin	Starhead Topminnow
Chain Pickerel	Sheepshead Minnow
Redfin Pickerel	Flier
Lake Chubsucker	Warmouth
Golden Shiner	Bluespotted Sunfish
Yellow Bullhead	Bluegill
Tadpole Madtom	Largemouth Bass
Mosquitofish	

2.09.04 Estuarine communities. The communities in this category are those that occur in the AIWW channel and right-of-way or directly adjacent to it.

2.09.04.1 Open waters. The sounds, bays, drowned river valleys, and channels traversed by the AIWW form the open water habitat. As defined here, open water includes all marine and estuarine waters together with all under-lying bottoms below the intertidal zone. Intertidal habitats are considered separately as salt marsh and tidal flat habitats. (Sections 2.09.04.2 and 2.09.04.3, following this discussion.)

2.09.04.1.1 The open water biota includes the plankton and nekton inhabiting the water column and the benthos living on or in the various types of substrata. The plankton is composed of many types of unicellular algae, various protistan groups (of which the protozoans are most important), larval stages of many invertebrates and fish, and the adult stages of several microscopic invertebrates. Larger animals, such as jellyfish and comb jellies that are carried passively by currents and tides because of their weak swimming ability are also included in the plankton.

2.09.04.1.2 Fish are the principal nekton, but some crustaceans such as portunid crabs, amphipods, and isopods, and some mollusks, such as squid spend at least part of their life as nekton. A number of the fish species in this community including many of importance to the sport and commercial fishery are considered to be estuarine dependent and utilize the coastal estuaries through which the waterway passes for at least a portion of their life cycle.

2.09.04.1.3 The benthic environment includes a number of communities correlated largely with substratum type. Multicellular green, red, and brown algae, unicellular algae (especially diatoms), are the primary producers within the photic zone of the benthic environment.

2.09.04.1.4 The benthic fauna is divided into two groups: epifauna, living on the substratum; and infauna, living within the substratum. Infaunal communities are dominated by a great diversity of burrowing and tube dwelling crustaceans (e.g. amphipods), polychaete worms, and by burrowing bivalve mollusks. Some infaunal invertebrates, especially among the crustaceans, are capable of a high degree of lateral mobility, but the majority can be regarded as essentially sedentary. The infauna is, with rare exception, comprised of filter and detritus feeding invertebrates.

2.09.04.1.5 The epifauna contains a diversity of animal groups associated with a diverse flora. Hard substrata, such as rocks, shell and gravel surfaces, and artificial surfaces, such as pilings, wrecks, and weirs support a rich assortment of attached plants and invertebrates. Typically, these communities contain red, green, and brown algae, barnacles, attached bivalves, anemones, corals, sea fans, bryozoans, tunicates, sponges, and foraminifera. The communities formed by these attached organisms host a number of both transient and permanent fish species, and motile invertebrates, including gastropod mollusks, starfish, sea urchins, crabs, and shrimp. Attached epifaunal invertebrates are principally filter and detritus feeders, but some motile organisms are carnivores.

2.09.04.1.6 The epifauna and flora of muddy and sandy bottoms tend to be much lower in diversity, and most inhabitants are microscopic. These surfaces are unsuitable for attachment by sessile invertebrates. In addition, many sand and mud bottoms are depositional and continual rain of sediment would quickly bury attached animals. Thus, these substrata support diatoms, other unicellular algae, protistans, and attached multicellular algae where turbidity is low. Invertebrates primarily include motile deposit feeders, such as polychaete worms, sea cucumbers, and some sand dollars. Some fish and crabs also graze on the bottom. Attached organisms are restricted largely to the occasional bits of shell or small rock lying on the surface. The development of oyster reefs on muddy intertidal bottoms, for example, is dependent on the presence of bits of shell or rock for initial larval attachment.

2.09.04.1.7 Some open water organisms can tolerate wide ranges of temperature and salinity, but the majority cannot. Tolerances to environmental parameters also change with life cycle phases. Larval or juvenile stages may have environmental requirements dissimilar from those of adult stages within the same species. Anadromous fish and many sedentary invertebrates also exhibit this trait. Seasonal

changes in the open water hydroclimate are reflected in the seasonality of occurrence and abundance of organisms. Many plants and animals are present in a given community for only part of their life cycle. For example, shrimp and several larval and juvenile fish utilize nutrient-rich coastal open water environments as nursery areas prior to migration to ocean habitats.

2.09.04.1.8 The open water community is also utilized by waterfowl and shorebirds particularly during the winter months. Many waterfowl are surface feeders and dabblers, and are commonly found along the shallow water zones where they feed on submerged or emergent vegetation. Species of birds which are found in the AIWW channel proper are principally diving or fish-eating species. Other vertebrates (i.e. mammals, reptiles, and amphibians) are poorly represented in the open water community except where mildly brackish conditions exist. Many of these are semi-aquatic and, thus, are temporary residents of the community.

2.09.04.1.9 The following is a list of typical floral and faunal inhabitants of communities associated with open water habitats:

Plankton

Diatoms
Dinoflagellates
Chlorophytes
Cryptophytes
Xanthophytes

Animals with Planktonic Larval Stages

Fish
Crabs
Barnacles
Mollusks
Polychaete Worms
Echinoderms
Jelly Fish
Comb Jellies
Copepods

Nekton

Amphipods
Isopods
Portunid crabs
Short-bodied Squid
Arrow Worm
Hickory Shad
Alewife
American Shad
Atlantic Menhaden
Gizzard Shad
Bay Anchovy
American Eel
Mummichog
Striped Killifish
Rainwater Killifish
Striped Bass
Spot
Atlantic Croaker
Bluefish
Spotted Seatrout
Weakfish
Red Drum
Striped Mullet
Summer Flounder
Tidewater Silverside
Atlantic Silverside
Pinfish
Atlantic Needlefish
Naked Goby
Crevalle Jack
Spanish Mackerel

Benthos

Diatoms
Foraminifera
Bacteria
Sponges
Anemone
Coral
Sea Fans
Hydroids
Polychaete Worms
Nematodes
Bryozoans
Amphipods
Isopods
Hemichordates
Tunicates
Red Algae
Brown Algae
Green Algae
Sea Urchins

Blue Crab
Calico Crab
Brown Shrimp
White Shrimp
Pink Shrimp
Grass Shrimps
Barnacles
Quahog
Sunray Venus
Eastern Oyster
Crested Oyster
Purplish Tagelus
Stout Tagelus
Common Razor Clam
Moon Snail
Oyster Drill
Welks
Sea Cucumber
Starfish

Birds

Common Loon
Red-throated Loon
Horned Grebe
Brown Pelican
Gannet
Double-creasted Cormorant
American Widgeon
Gadwall
Mallard
Black Duck
Pintail
Blue-winged Teal
Shoveler
Lesser Scaup
Greater Scaup
Canvasback

Ruddy Duck
Bufflehead
Common Scoter
Surf Scoter
Red-breasted Merganser
Hooded Merganser
Osprey
Laughing Gull
Ring-billed Gull
Herring Gull
Black Skimmer
Royal Tern
Caspian Tern
Forster's Tern
Least Tern
Belted Kingfisher

Mammals

Bottle-nosed Dolphin

Reptiles and Amphibians

American Alligator
Carolina Diamondback Terrapin
Atlantic Loggerhead

2.09.04.2 Tidal marshes. The coastline of South Carolina is about 187 miles long and its numerous estuaries and inlets create a coastal environment along some 2,880 miles of shoreline which adjoins approximately 450,000 acres of tidal marsh. (South Carolina Water Resources Commission, 1970).

2.09.04.2.1 Coastal South Carolina marshes historically have been recognized for their value to fish and wildlife resources. The productive role of these lands has been well illustrated and stressed by Lunz (1967 and 1968). The vegetation of the marshlands complex along the AIWW is varied and it is now recognized that the types of vegetation present play a key role in the processes of biological productivity. Research by Odum and de la Cruz (1967) has shown that salt marsh grasses, by converting inorganic nutrients and sunlight into plant tissue, act as energy transfer mechanisms to consumer organisms in the estuarine system. Field observations and experimental trawling operations at various places along the waterway have clearly shown that tremendous quantities of dead marsh vegetation are transported to adjacent estuarine waters during the winter and early spring at times of extremely high tides. Teal (1962) has calculated that approximately 45 percent of the total plant material is transported out of Georgia salt marshes into the estuary. This is also true in South Carolina where the tidal range is large. Dead grass may become waterlogged and sink to the bottom or may be physically as well as biologically disintegrated into particulate organic detritus, becoming food for various invertebrates. These organisms are in turn eaten by small fish which are subsequently consumed by larger predators, etc. Thus the link between fish and marsh is evident. It is estimated that only about seven percent of the marsh grass is eaten by insects, with the remainder being consumed by detritus feeding organisms such as amphipods, isopods and decapod crustaceans (shrimp and crabs), and fishes. Penead shrimp are dependent on marshes as "nursery" areas where they take up a bottom dwelling existence. Growth in marshes is rapid. Commercial value of shrimp in reaction to other categories can be seen in Table 7.

2.09.04.2.2 Productive salt marshes along the waterway are dominated by smooth cordgrass which occurs as tall, intermediate and short forms, depending on elevation. Tall cordgrass grows vigorously in areas below the elevation of the mean high tide and is the most productive of the three types. Odum and de la Cruz (1967) reported that smooth cordgrass produces approximately 2,000 g/m^2 or 10 tons per acre (dry weight) in Georgia marshes; this figure is applied to the entire crop of this species in Georgia. While there is evidence to infer that Georgia marshes do not average 10 tons per acre (actually 2,240 g/m^2) as reviewed by Wass and Wright (1969), there are data indicating that smooth cordgrass averages more than 4.4 (985 g/m^2) in North Carolina saltmarsh (Williams, 1969). These data suggest that annual production in South Carolina saltmarshes would range between 2.9 and 4.4 tons per acre at a minimum. Some marshes along the waterway would probably be somewhat higher in production than the State's average since the cordgrass so prevalent in these areas appears to be extremely vigorous. Nutrients from sewage pollution in years past may have been beneficial in stimulating growth in some areas along the waterway even though the water quality was degraded. Marshall (1970) showed that cordgrass marsh receiving sewage plant effluent produced more biomass, reached its peak biomass sooner and was apparently not injured by fertilization.

2.09.04.2.3 Tidal marshes also function as shoreline stabilizers and protect the adjacent upland terrestrial communities from storm erosion. The marsh communities also serve to purify water and act as sediment traps for materials brought in by tidal overwash. As the sediments accumulate around the numerous plant stems and coastal subsidence proceeds, the marsh, and subsequently the biotic communities adjacent to it, encroach upon the estuarine waters.

2.09.04.2.4 As mentioned previously, tidal marshes are present in the littoral zones along most of the waterway. They represent a transitional zone between open water and upland terrestrial habitats. Vegetation in the tidal marshes is dominated by emergent, narrow-leaved rushes, sedges, and grasses. Soils are generally composed of poorly drained peats and mucks, and anaerobic conditions are usually present beneath the ground surface. Meandering throughout many of these communities are numerous tidal creeks laden with suspended silts and particulate organic matter.

2.09.04.2.5 The water salinity of the AIWW between Georgetown and Myrtle Beach is lower than that of other reaches because of few connections with the ocean. The vegetation in this reach also differs somewhat from that of the rest of the waterway. The topographically lower marsh zones are still affected by lunar tides and are inundated on a regular basis. Many of the highly salt tolerant species, such as smooth cordgrass become less abundant as salinities diminish. Tidal marshes along this reach contain such species as big cordgrass, wild rice, reeds, southern wild rice, bulrush, cattail, pickerelweed and spikerush.

2.09.04.2.6 Water salinity in most other areas of the waterway is higher and marsh vegetation is composed of species that are adapted to higher water salinity. Marsh vegetation is typically arranged in four distinct zones. The topographically lowest and first emergent zone occurs from about mean sea level (msl) to about mean high water (mhw). This marsh region is regularly flooded by semidiurnal lunar tides and is dominated by smooth cordgrass. This species usually grows in dense stands and attains its greatest height where inundation is most frequent.

2.09.04.2.7 A belt of glasswort is sometimes present along the upper [illegible] this low marsh zone. The second vegetational zone occurs beyond this and includes that portion of the marsh that is inundated [illegible] by lunar driven tides. Black needlerush is the dominant plant species in this region and usually occurs in relatively pure, dense stands, but intermediate and stunted forms of smooth cordgrass are also present. Beyond the black needlerush region, the marsh is composed of a mixture of saltmeadow cordgrass and saltgrass which, in many areas, forms a mixed herb-shrub association along the upper edge of the marsh. Species present in this highest zone include sea ox[illegible], saltwort, glasswort, saltwort, wax myrtle, and marsh fleabane.

2.09.04.2.8 Tidal marshes are important wildlife habitats. The dense plant growth in these areas provides excellent cover for many species of nesting birds, aquatic and semi-aquatic mammals, reptiles, and amphibians. Substrates in these communities are inhabited by a myriad of foraminiferans, nematodes, annelids, arthropods, and mollusks. A representative list of tidal marsh fauna is given below:

Birds

American Bittern
Great Blue Heron
Little Blue Heron
Common Egret
Snowy Egret
Louisiana Heron
Green Heron
Black-crowned Night Heron
Yellow-crowned Night Heron
Glossy Ibis
White Ibis
Black Duck
Mallard
Pintail
Gadwell
American Widgeon
Shoveler
Blue-winged Teal
Marsh Hawk
Clapper Rail
Sora
King Rail
Virginia Rail
Willet
Gull-billed Tern
Greater Yellowlegs
Lesser Yellowlegs
Long-billed Marsh Wren
Short-billed Marsh Wren
Red-winged Blackbird
Boat-tailed Grackle
Seaside Sparrow
Sharp-tailed Sparrow
Swamp Sparrow
Song Sparrow

Mammals

Marsh Rabbit
Marsh Rice Rat
Muskrat
River Otter
White-tailed Deer
Mink
Raccoon
Norway Rat

Reptiles and Amphibians

Eastern Mud Turtle
Carolina Diamondback Terrapin
Alligator
Eastern Cottonmouth
Snapping Turtle
Red-bellied Turtle
Brown Water Snake
Red-bellied Water Snake
Black Swamp Snake
Greater Siren
Mudpuppy
Bullfrog

Invertebrates

Foraminifera
Moss Animals
Nematodes
Amphipods
Isopods
Polychaete Worms
Blue Crab
Mud Crabs
Flat Mud Crabs
Red-jointed Fiddler Crab
Mud Fiddler Crab
Sand Fiddler Crab
Square-backed Crabs
Barnacles
Ribbed Mussel
Carolina Marsh Clam
Marsh Periwinkle
Mud Snail
Melampus Snail

2.09.04.3 Tidal flats. Tidal flats occur along the shallow areas of the AIWW channel and tidal creeks and are composed of sand or mud. These flats are typically devoid of vascular plants but are frequently inhabited by numerous species of diatoms and bacteria. Tidal flats are alternately covered and exposed by wind-driven or lunar tides. The tidal action provides a constant influx of particulate organic matter to these habitats, creating a rich nutrient supply for filter-feeding benthic invertebrates. When the tidal flats are covered by water, these animals and nutrients constitute an important food source for a variety of fish species. When the flats are exposed, the nutrients and benthic animals are fed upon by numerous wading birds and shorebirds. A representative faunal list is as follows:

Birds

Great Blue Heron
American Egret
Snowy Egret
Louisiana Heron
Black-crowned Night Heron
Yellow-crowned Night Heron
Glossy Ibis
White Ibis
American Oystercatcher
Semipalmated Plover
Wilson's Plover
Willet
Greater Yellowlegs
Lesser Yellowlegs
Short-billed Dowitcher
Long-billed Dowitcher
Dunlin
Semipalmated Sandpiper
Western Sandpiper
Herring Gull
Ring-billed Gull
Laughing Gull
Least Tern
Royal Tern
Gull-billed Tern
Caspian Tern
Black Skimmer

Reptiles and Amphibians

Carolina Diamondback Terrapin

Invertebrates

Atlantic Jacknife Clam
Purplish Tagelus
Stout Tagelus
Eastern Oyster
Blue Crab
Sunray Venus
Cross-barred Venus
Quahog
Lettered Olive

2.09.04.4 Dredged material islands. Dredged material islands have been created as a result of AIWW construction and maintenance dredging operations. They occur along the waterway where dredged sediments have been discharged into shallow water zones, on marshlands, and on upland habitats. The original biotic communities that were present on these sites prior to disposal have been obliterated. Upon revegetation, these areas usually contain several biotic communities that are similar in appearance and composition to those which naturally occur in the surrounding environment.

2.09.04.4.1 Generally, most dredged material islands are topographically higher along their central inland portions and grade gradually downward, forming a dome-shaped emergent land mass. Soils on the islands are alkaline and consist of fine to coarse grained sand, shell, and silt. The percentage that each occurs on an individual island is variable and often dependent on whether the island was a disposal site for new work or for maintenance dredging. Sediments from the former usually contain a substantial amount of coarse-grained sand whereas sediments from the latter consist predominantly of silt and fine-grained sand.

2.09.04.4.2 Most of the islands created during early construction and maintenance periods of the AIWW were not diked and permitted dredged material runback. These islands typically gave a low slope and profile. Their sediments tend to be horizontally stratified with the larger, coarser particles found on the high, central portions of the island, grading to finer silt and sand around the island edges. Diked dredged material islands, on the other hand, usually have much greater relief and when filled to capacity, the sediments tend to be vertically stratified with the coarser sediments settling to the bottom and the finer sediments on top.

2.09.04.4.3 The floristic composition of any individual dredged material island is dependent upon frequency of overwash, salinity of the surrounding water, influence of salt spray, island topography, physiochemical make-up of sediments, and length of time since the island was last used as a dredged material disposal site. Bird colonies may also have an effect on vegetation as their guano acts as a soil fertilizer.

2.09.04.4.4 If present, the vegetation on most dredged material islands is arranged in concentric zones. Tidal marsh vegetation usually occupies the topographically low areas around the island edges. This is often followed by a sparse to dense herb-shrub zone, which may occasionally cover the entire central portion if the island has a low relief. On some of the older dredged material islands, the herb-shrub zone has in certain cases succeeded to an upland forest. When an area is diked, silverling and poke berry are usually the first plants to appear inside the diked area after each use and they quickly form a dense ground cover. These plants are killed if covered to a sufficient depth during subsequent dredging operations but quickly become re-established.

2.09.04.4.5 Wildlife use of dredged material islands is variable. Black skimmers, American oystercatchers, terns, gulls, herons, egrets, and ibises frequently utilize these islands for colonial nesting and feeding purposes. Shorebird species nest on the ground, preferably on islands devoid of or sparsely covered with vegetation, whereas the wading birds nest in shrubs or trees, preferably on islands vegetated with shrub thickets or upland forests. Other animals utilizing these areas are raccoon, black rat, blue jays, robins, several species of reptiles and amphibians, owls, hawks, and several species of dickeys.

2.09.05 Other communities.

2.09.05.1 Agricultural lands. Many of the natural communities along the AIWW have been converted to croplands and pasturelands. In creating these habitats most of the natural vegetation has been destroyed and replaced by shrub or herbaceous growth. Croplands along the AIWW are devoted mainly to corn, soybeans, tobacco, and truck farming crops. Pasturelands are frequently planted with bermuda grass or carpet grass.

2.09.05.1.1 Rice was formerly an important crop along many areas of the waterway and large areas of marshland were diked for the culture of rice. Maintenance of the peripheral dikes of some of these rice fields has been discontinued and the fields have reverted to marsh and/or cypress swamp. In some areas the dikes have been maintained to provide waterfowl habitat.

2.09.05.1.2 Agricultural fields that are left fallow after harvest provide food and cover for a variety of wildlife species. These include many game animals, such as bobwhite, mourning dove, white-tailed deer, and eastern cottontail. A more complete listing of animals commonly found in agricultural lands along the waterway is presented below:

Birds

Red-tailed Hawk
Turkey Vulture
Bobwhite
Mourning Dove
Ground Dove
Killdeer
Common Nighthawk
Eastern Kingbird
Eastern Phoebe
Barn Swallow
Tree Swallow
Common Crow
Fish Crow
Mockingbird
Robin
Eastern Bluebird
Loggerhead Shrike
Starling
House Sparrow
Eastern Meadowlark
Red-winged Blackbird
Common Grackle
Brown-headed Cowbird
Indigo Bunting
American Goldfinch
Savannah Sparrow
Vesper Sparrow
Slate-colored Junco
Chipping Sparrow
Field Sparrow

Mammals

Virginia Opossum
Short-tailed Shrew
Least Shrew
Eastern Mole
Eastern Cottontail
Eastern Harvest Mouse
Hispid Cotton Rat
House Mouse
Norway Rat
Black Rat
Striped Skunk
White-tailed Deer

Reptiles and Amphibians

Eastern Glass Lizard
Eastern Slender Glass Lizard
Eastern Hognose Snake
Southern Black Racer
Mole Snake
Rough Green Snake
Southern Copperhead

2.09.05.2 Man-dominated communities. The habitats that fall within this caterogy include roads, boat marinas, homesites, utility corridors, drainage ditches, mowed rights-of-way, etc. Such habitats occur near or along numerous areas of the waterway.

2.09.05.2.1 Where commercial and residential structures have been constructed, most of the biota associated with the original communities has been displaced. Although parts of such habitats may retain vegetational features reminiscent of the disrupted biotic community, for instance live oaks on the lawn, the species composition has generally been greatly altered or reduced and often replaced by ornamental species.

2.09.05.2.2 In man-dominated communities such as utility corridors and rights-of-way, the original plant associations have reverted to earlier stages of secondary succession and the tree and shrub species present are often prevented from reaching tree canopy height as a result of mowing, spraying, etc.

2.05.05.2.3 Species inhabiting man-dominated communities include the following:

Birds

Screech Owl
Ruby-throated Hummingbird
Common Flicker
Red-headed Woodpecker
Downy Woodpecker
Mourning Dove
Eastern Kingbird
Purple Martin
Blue Jay
Common Crow
Fish Crow
Carolina Chickadee
Tufted Titmouse
Mockingbird
American Robin
Brown Thrasher
Starling
House Sparrow
Boat-tailed Grackle
Brown-headed Cowbird
Orchard Oriole
Cardinal
Slate-colored Junco

Mammals

Virginia Opossum
Eastern Mole
Bats (several species)
Southern Flying Squirrel
Eastern Gray Squirrel
House Mouse
Norway Rat
Black Rat

Reptiles and Amphibians

Green Anole
Rough Green Snake
Southern Toad
Oak Toad
Squirrel Treefrog
Pine Woods Treefrog

2.09.06 Rare and endangered animal species. There are nine endangered species, one threatened species, one peripheral species and three status undetermined species which occur or possibly occur in the vicinity of the waterway.

2.09.06.1 Endangered species. Endangered species can be defined as those species in danger of extinction throughout all or a significant portion of their range. Their peril may result from one or more causes--loss of habitat or change in habitat, overexploitation, predation, competition or disease.

Endangered species [1/] are:

Fish	
Shortnose sturgeon	Acipenser brevirostrum
Reptiles and Amphibians	
American alligator	Alligator mississipiensis
Birds	
Eastern brown pelican	Pelecanus occidentalis carolinensis
Southern bald eagle	Haliaeetus l. leucocephalus
Peregrine falcon	Falco peregrinus
Bachman's warbler	Vermivora bachmanii
Kirtland's warbler	Dendroica kirtlandii
Eskimo curlew	Numenius borealis
Red-cockaded woodpecker	Dendrocopus borealis

The shortnose sturgeon was a resident of Atlantic seaboard rivers from New Brunswick to Florida, however, most recent records are from the Hudson River. The alligator is commonly observed in freshwater rivers and lakes. The brown pelican is a commonly observed resident of coastal South Carolina and nests in many areas along the coast. The bald eagle is a permanent resident of the state and individuals have recently been sighted near Georgetown and on Kiawah Island. The peregrine falcon, Kirtland's warbler and the Eskimo curlew are transient species. According to the U. S. Fish and Wildlife Service, Bachman's warbler, one of the rarest of our small birds, has been observed in the I'on Swamp. The red-cockaded woodpecker is a resident of the old-age pine woodlands.

2.09.06.2 Threatened species. Threatened species can be defined as those species likely to become endangered in the foreseeable future. The green turtle, Chelonia mydas, is a resident of the open sea and may occasionally be observed during nocturnal egg laying migrations on sandy coastal beaches.

2.09.06.3 Peripheral species. A peripheral species--"is one whose occurence in the United States is at the edge of its natural range and which is threatened with extinction within the United States

1/ These species also appear on the Department of Interior's "List of Endangered Fauna", May, 1974.

although not in its range as a whole". The only peripheral species known to occur in the project area is the roseate spoonbill (Ajaia ajaja) which is a transient.

2.09.06.4 Status undetermined species. A status undetermined species--"is one that has been suggested as possibly being rare or endangered, but about which there is not enough information to determine its status". The following species are in this category:

American osprey	Pandion haliaetus carolinensis
Wood ibis	Mycteris americana
Eastern pigeon hawk	Falco c. columbarius

The osprey is locally common and has been observed nesting in several areas along the waterway. It is not disturbed by human development and uses some of the larger navigational towers for nesting. The wood ibis is frequently seen singly or in pairs along and in the vicinity of the waterway, and one flock of 25 birds was recently seen south of Charleston. The pigeon hawk is seen only occasionally.

2.09.07 Rare and endangered plant species. There are no endangered plants in the project area. Nine plants found in Horry, Georgetown, Charleston, Colleton and Beaufort counties are listed as threatened in House Document No. 94-S1, 94th Congress, "Report on Endangered and Threatened Plant Species of the United States," Smithsonian Institution, 1975.

Species	Habitat	Counties Where Found (Radford, Ahles and Bell)
Arenaria godfreyi	seepage slopes in marl woods	Horry
Dionaea muscipula	wet, sandy ditches, bog margins	Horry, Georgetown, Charleston
Lachnocaulon berychianum	ditches, bogs	Horry
Lindera melissaefolium	sandy sinks, pond margins	Colleton
Litsea aestivalis	pond and swamp margins, wet woodlands	Georgetown, Charleston
Calamovilfa brevipilus	bogs and savannahs	Georgetown
Asplenium heteroresiliens	marl outcrops	Charleston
Sarracenia rubra	bogs and savannahs	Horry, Georgetown, Charleston, Beaufort
Schisandra glabra	twining woody vine	Charleston, Beaufort

2.10 Historical and archaeological sites.

2.10.01 Historical sites. South Carolina's history began in the coastal areas where the first cities and trading routes were established. As a result, the five coastal counties through which the waterway passes contain an abundance of historic homes, churches, public buildings and sites. Charleston, Georgetown, Beaufort, McClellanville, and many smaller towns along the coast contain original homes and buildings of historic value. Coastal South Carolina also contains the George Washington Trail which generally follows U. S. Highway 17 and roughly parallels the old Kings Highway traversed by President Washington in 1791. Coastal South Carolina properties listed in the National Register of Historic Places are discussed in the following paragraphs.

2.10.01.1 Horry County. The Old Horry County Courthouse and Jail located in Conway, about 12 miles inland of the waterway is the only National Register property listed for Horry County.

2.10.01.2 Georgetown County. Georgetown and Pawleys Island contain the areas most significant historic resources. Georgetown, laid out in 1729, is the state's third oldest city. Situated in the center of a major rice producing area, the city became a leading exporter of rice during the 1850's. Pawleys Island, located just up the coast from Georgetown is one of the state's first beach communities. It was developed by inland plantation owners trying to escape their malaria infested ricefields. There are six Georgetown County properties listed in the National Register of Historic Places.

2.10.01.3 Charleston County. Charleston is the site of one of the oldest permanent settlements in the United States and has many areas and structures of great significance in the history of the country which span the period between the Revolutionary War and the post Civil War and Reconstruction period. Prominent among these is Fort Sumter which is the site of the first battle of the Civil War when it was fired upon by South Carolina troops from nearby Fort Johnson. Fort Sumter is a National Monument on a small man-made island in Charleston Harbor. Another old fort and also a National Monument is Fort Moultrie on the southwest end of Sullivans Island near the mouth of Charleston Harbor. The original palmetto fort was begun in 1776 and has been rebuilt several times. The grave of General Francis Marion, a Revolutionary War hero, is located near Pineville, just north of the project area. Boone Hall is an estate of about 738 acres just north of Charleston that was named for Major John Boone, who received the land as a grant in 1681 from the Lords Proprietors on behalf of the King of England. The mansion, gin-house, and slave houses have been restored and depict some aspects of local heritage and culture of the pre-Revolutionary era. There are currently 59 Charleston County properties listed in the National Register of Historic Places.

2.10.01.4 Colleton County. National Register properties in Colleton County are located inland of the waterway in Walterboro, and in the vicinity of Jacksonboro and Williams. A total of five Colleton County properties are listed on the National Register of Historic Places.

2.10.01.5 Beaufort County. Beaufort County's recorded past dates back to the landing of Spanish explorers on Port Royal Island in 1521. The town of Beaufort was chartered in 1710 and is the second oldest city in the state. A total of 12 Beaufort County properties are listed in the National Register of Historic Places.

2.10.01.6 The State Historic Preservation Officer states that there are no known historical properties, including those eligible for the National Register, that need to be taken into account during the proposed maintenance. (See comment in Appendix A.)

2.10.02 Archaeological sites. Archaeological sites of interest in the coastal counties include the site of Old Charles Towne, Sewee Mound, Auld Mound, Buzzard's Island site, Fig Island site, Hanckel Mound, and the Horse Island shell ring in Charleston County; and Skull Creek (Hilton Head) and Chester Field shell rings in Beaufort County. None of these properties are located in the immediate vicinity of the waterway. Surveys will be conducted prior to the selection of new disposal areas. Neither the existing channel bottom nor the disposal sites now in use are likely to yield valuable archaeological finds. A meeting will be held with the State Archaeologist to determine any damage along the existing banks to areas of possible archaeological significance.

2.11 Socio-economics.

2.11.01 Population. The five coastal counties traversed by the AIWW contain about 16.6 percent of the state's population with a 1970 census total of 429,900. Population trends are mixed but overall the coastal counties showed an average population increase of 5.68 percent. Colleton and Georgetown Counties showed the only decrease at 0.7 and 3.7 percent, respectively. Beaufort and Charleston Counties showed the greatest change with increases of 15.7 percent for the former and 14.5 percent for the latter. These increases are most likely due, at least in part, to the large military installations in both areas.

2.11.01.1 The following text table presents comparative population data on the five coastal counties for the 1960 and 1970 census periods.

County	Population		% Change
	1970	1960	
Charleston	247,650	216,382	+14.5
Horry	69,992	68,247	+ 2.6
Beaufort	51,136	44,187	+15.7
Georgetown	33,500	34,798	- 3.7
Colleton	27,622	27,816	- 0.7

2.11.01.2 There are three urban centers of population near the waterway; those being Georgetown, with a population of 10,499, Charleston with a population of 228,399, and Beaufort, with a population of 9,434. Myrtle Beach, a very popular summer resort, is a short drive from the waterway and has a permanent population of 8,536.

2.11.02 Economic development.

2.11.02.1 General. Economic development along the waterway varies from large uninhabited areas such as Cape Romain National Wildlife Refuge to urban population centers such as Beaufort, Charleston, Georgetown, and Myrtle Beach. Industrial development in the vicinity of the waterway is mostly concentrated in these urban population centers. Industries in Georgetown include paper, steel, and chemical manufacturing plants, commercial fishing and lumber and pulpwood yards. Charleston industries include paper, steel, chemical, fertilizer, commercial fishing, and boat manufacturing. A large commercial fishing fleet operates out of Shem Creek in Mt. Pleasant. Industries located along the waterway in Beaufort are mainly related to the commercial fishing industry.

2.11.02.2 Commercial fishing. As might be expected in a coastal area, commercial fishing is an important contributor to the economy of the state. In 1974, commercial finfish and shellfish landings totalled 18.2 million pounds valued at 6.7 million dollars. The shrimp catch is the most valuable, bringing 4.6 million dollars for 7.1 million pounds in 1974. Oyster and blue crab catches in 1974 were valued at $952,691 and $556,747, respectively. Finfish landings amounted to 2.7 million pounds valued at $486,003. Table 7 lists total catch in pounds and value for the coastal counties during the period 1964-1974.

TABLE 7

COMMERCIAL FISHERY LANDINGS FOR THE PERIOD 1964-1974

Shrimp (Heads on)

Year	Northern[1] Pounds	Northern[1] Dollars	Central[2] Pounds	Central[2] Dollars	Southern[3] Pounds	Southern[3] Dollars
1964	[illegible]	[illegible]	[illegible]	2,398,584	2,255,036	1,651,107
1965	[illegible]	[illegible]	[illegible]	[illegible]	2,846,792	3,071,750
1966	[illegible]	[illegible]	[illegible]	[illegible]	2,628,371	1,891,466
1967	[illegible]	[illegible]	[illegible]	[illegible]	3,927,655	2,502,616
1968	[illegible]	[illegible]	[illegible]	[illegible]	1,643,704	942,782
1969	[illegible]	[illegible]	[illegible]	[illegible]	1,939,275	1,909,272
1970	[illegible]	[illegible]	[illegible]	[illegible]	2,517,411	1,655,913
1971	[illegible]	[illegible]	[illegible]	[illegible]	1,471,268	964,914
1972	[illegible]	[illegible]	[illegible]	[illegible]	1,164,914	1,649,717
1973	[illegible]	[illegible]	[illegible]	[illegible]	2,196,474	2,110,156
1974	[illegible]	[illegible]	[illegible]	[illegible]	979,526	417,228

Blue Crab (Hard)

Year	Northern Pounds	Northern Dollars	Central Pounds	Central Dollars	Southern Pounds	Southern Dollars
1964	22,440	3,970	1,415,160	196,963	5,949,324	751,755
1965	9,599	1,701	2,408,060	420,108	5,451,400	713,563
1966	[illegible]	931	1,519,222	188,146	3,899,720	608,534
1967	[illegible]	253	1,226,444	106,579	6,228,767	509,175
1968	[illegible]	305	937,743	64,125	6,002,529	390,767
1969	14,310	1,305	1,206,115	107,800	7,029,117	565,591
1970	1,147	57	581,468	43,709	5,279,386	251,[illegible]
1971	[illegible]	[illegible]	623,920	48,114	[illegible]	[illegible]
1972	[illegible]	[illegible]	734,703	[illegible]	[illegible]	[illegible]
1973	[illegible]	[illegible]	1,194,618	70,[illegible]	6,021,422	295,843
1974	[illegible]	[illegible]	2,096,258	81,[illegible]	7,339,[illegible]	[illegible]

Oysters (Meats)

Year	Northern Pounds	Northern Dollars	Central Pounds	Central Dollars	Southern Pounds	Southern Dollars
1964	[illegible]	[illegible]	[illegible]	[illegible]	669,[illegible]	398,414
1965	56,137	29,660	[illegible]	[illegible]	[illegible]	344,749
1966	38,[illegible]	19,[illegible]	[illegible]	[illegible]	[illegible]	343,328
1967	[illegible]	19,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1968	[illegible]	[illegible]	[illegible]	[illegible]	556,646	334,087
1969	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	407,992
1970	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	462,935
1971	74,288	[illegible]	[illegible]	[illegible]	[illegible]	481,335
1972	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	536,234
1973	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	595,584
1974	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	567,[illegible]

Total Shellfish

Year	Northern Pounds	Northern Dollars	Central Pounds	Central Dollars	Southern Pounds	Southern Dollars
1964	[illegible]	[illegible]	[illegible]	[illegible]	4,878,839	2,809,711
1965	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1966	[illegible]	[illegible]	[illegible]	[illegible]	3,753,421	2,490,903
1967	[illegible]	[illegible]	[illegible]	[illegible]	11,029,025	3,472,812
1968	[illegible]	[illegible]	[illegible]	[illegible]	8,208,191	1,672,911
1969	[illegible]	[illegible]	[illegible]	[illegible]	13,232,006	2,482,875
1970	[illegible]	[illegible]	[illegible]	[illegible]	7,123,731	2,377,323
1971	[illegible]	[illegible]	[illegible]	[illegible]	7,218,815	1,300,632
1972	[illegible]	[illegible]	[illegible]	[illegible]	9,005,381	1,646,142
1973	[illegible]	[illegible]	[illegible]	[illegible]	9,889,298	1,679,956
1974	[illegible]	[illegible]	[illegible]	[illegible]	9,721,472	1,169,887

Total Finfish

Year	Northern Pounds	Northern Dollars	Central Pounds	Central Dollars	Southern Pounds	Southern Dollars
1964	1,406,848	210,738	1,438,188	266,894	37,058	8,621
1965	2,212,976	437,622	1,579,989	238,217	93,740	17,115
1966	3,331,228	406,927	1,790,963	293,672	93,133	17,763
1967	2,881,083	298,174	1,809,025	224,423	82,597	13,563
1968	2,193,366	231,435	979,630	133,672	19,113	2,574
1969	2,348,099	320,344	3,109,775	22,[illegible]	18,063	2,497
1970	4,150,628	251,272	4,764,894	309,861	23,[illegible]	13,822
1971	3,184,617	199,576	4,014,116	283,914	82,202	9,451
1972	[illegible]	[illegible]	[illegible]	[illegible]	71,008	9,683
1973	[illegible]	[illegible]	[illegible]	[illegible]	124,903	16,406
1974	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

1 Includes Georgetown, Horry and Marion counties, S.C.

2 Includes Charleston, Berkeley and Dorchester Counties, S.C.

3 Includes Beaufort, Colleton, Jasper and Hampton counties, S.C.

(From: S.C. Landings, Annual Summaries, U.S. Dept. of Commerce in cooperation with the S.C. Wildlife and Marine Resources Dept.)

2.11.02.3 Recreation and tourism. Tourism, especially that associated with recreation is one of the most important industries in the coastal area. Spending by tourists and travelers in South Carolina amounted to $337 million in 1968 with $250 million of that total being spent in the coastal region. In addition, a 1968 study conducted by the South Carolina Department of Parks, Recreation and Tourism indicated that 74.4 percent of those people that listed South Carolina as their destination visited the coastal areas of the state. In the Myrtle Beach area alone, tourist and traveler spending exceeded $100 million. The major activities attracting tourists to the region are boating, swimming, sport fishing, golfing, and sightseeing.

2.11.02.3.1 The coastal region contains a total of five coastal state parks: (1) Myrtle Beach State Park is a 312-acre site located just south of the city of Myrtle Beach; (2) Huntington Beach State Park is located 15 miles north of Georgetown and 20 miles south of Myrtle Beach and covers 2,800 acres; (3) Edisto Beach State Park covers 1,255 acres and is located south of Charleston; (4) Hunting Island State Park, a 5,000-acre park located near Beaufort; and (5) Capers Island State Park, a 2,200-acre park. South Carolina has recently initiated projects on the 23,700-acre Santee Coastal preserve and the Waterfront Park in Georgetown.

2.11.02.3.2 Just north of McClellanville, the waterway becomes the northern boundary of the Cape Romain National Wildlife Refuge, a 55,066-acre area of tidal creeks, bays, barrier islands, and marshland. Although the refuge is accessible only by boat, it is visited each year by thousands of people interested in such activities as photography, nature study, camping, hunting, picnicking, fishing, and beach combing.

2.11.02.4 Employment. The average annual employment in the state in 1970 totaled 1,039,900 with 5.0 percent of the labor force unemployed. About 340,000 persons or 32.7 percent were employed in manufacturing activities, 66,200 or about 6.4 percent were employed in agriculture, 149,900 or about 14.4 percent were employed in government, 141,800 or 13.6 percent were employed in wholesale and retail trade, and the remainder were either self-employed or in contract construction, transportation, communication, utilities, finance, insurance, real estate, or domestics. Selected 1970 employment data for the state and the five counties through which the waterway passes are presented in Table 8.

2.11.02.5 Income. The total personal income of residents living in the State of South Carolina amounted to about $7,550 million in 1970 and averaged $2,908 per capita, in current dollars, or about 74 percent of the national average. This represents an increase of about 60 percent in real per capita income over 1960 as compared with about 35 percent for the nation as a whole. The per capita income in the project area generally parallels that of the state as a whole.

Table 8

Work Force Estimates[1/]
1970

	State of S.C.	Beaufort County	Charleston County	Colleton County	Georgetown County	Horry County
Civilian labor force (No.)	1,094,200[2/]	12,700	98,600	10,150	12,750	27,250
Unemployment	5.0%	4.7%	4.5%	5.9%	7.5%	6.4%
Employment (No.)	1,039,900	12,100	94,150	9,550	11,800	25,500
Agricultural (No.)	66,200	1,100	1,650	1,300	800	3,900
Non-agricultural (No.)	973,700	11,000	92,500	8,250	11,000	21,600
Manufacturing (No.)	340,000	850	12,900	2,450	4,450	3,550
Contract construction (No.)	51,500	750	5,450	300	250	1,300
Transportation, communication, and public utilities	37,500	300	5,500	300	250	600
Wholesale and retail trade	141,800	1,550	16,900	1,150	1,500	4,600
Finance, insurance, and real estate	29,700	750	3,550	250	200	750
Service	87,400	1,350	9,800	750	850	3,450
Government	149,900	3,400	26,650	1,300	1,250	3,200
Other non-manufacturing	4,200	50	200	150	300	100
Self-employed, unpaid family workers and domestics	131,700	2,000	1,550	1,600	1,950	4,050

1/ Data extracted from South Carolina's Manpower in Industry, Annual Averages for 1970-1971. S. C. Employment Securities Commission, May, 1972.

2/ Includes workers involved in labor management dispute.

2.11.02.6 Waterway vessel traffic. Boat traffic on the AIWW (Charleston District) is, with the exception of governmental and waterway maintenance vessels, composed of commercial vessels carrying commodities, recreational craft and fishing boats. Total freight tonnages moved along the AIWW for the 10-year period 1964 to 1973 are listed in Table 9. Numbers of trips on this section of the waterway for all self-propelled and non-self-propelled vessels during 1973 totaled 27,198 northbound and 31,562 southbound. In both cases, self-propelled dry cargo vessels were the dominant carriers.

Table 9

Comparative Statement of Traffic on the South Carolina AIWW, 1964-1973

Year	Tons	Year	Tons
1974	1,573,786		
1973	1,614,002	1968	1,579,869
1972	1,559,024	1967	1,420,056
1971	1,367,161	1966	1,292,496
1970	1,395,750	1965	1,400,181
1969	1,621,016	1964	1,488,744

2.11.02.6.1 The major commodities moved along the waterway include pulpwood logs and pulp; iron ore and concentrates; coke; jet fuel; paper and paperboard; iron and steel plates, sheets and products; fabricated metal products; miscellaneous food products; shellfish; gasoline; and distillate fuel oil.

2.11.02.6.2 Records of recreational traffic on the AIWW are not compiled on an annual basis, and the only sources of information on such traffic are the activity logs maintained by bridge operators. These logs list all bridge openings and the types of vessels requiring bridge openings. As a rule, records are not maintained on vessels not requiring bridge openings.

2.11.02.6.3 Monthly traffic flow in 1968 was tabulated by Leisure Systems, Incorporated (1969) for two bridges in North Carolina and for the Little River bridge in South Carolina. Commercial traffic was found to be constant throughout the year while recreational traffic showed a marked seasonality, with a pronounced northbound peak flow in May and an even greater southbound peak in October. About 35% of the total AIWW traffic was found to be recreational vessels and consisted overwhelmingly of transient through traffic originating from Virginia northward or in Florida to the south.

3.0 Relationship of the Proposed Action To Land Use Plans

Since the AIWW has been in use since the early 1930's, all land use plans and policies account for the continued use of the waterway and its right-of-way. There are no existing Federal, State or local land use plans, policies or controls which would be affected by the continued maintenance of AIWW.

4.0 The Probable Impact of the Proposed Action on the Environment

4.01 General. As discussed in Section 1.0, material dredged from the AIWW is now placed in diked disposal areas within a 1,000-foot easement adjacent to the waterway provided for this purpose by the State of South Carolina. Since most of the waterway is bordered on both sides by marsh, the easement consists primarily of marsh. Material dredged during construction and for many years thereafter was deposited in undiked areas within this easement area. The use of dikes to retain the dredged material was undertaken in recent years to prevent the runback of dredged material, and all future dredging operations, except for marsh building efforts, will probably utilize diked disposal techniques. To date, only a small portion of the total easement area provided by the State has actually been used; but all of this easement or an equivalent area may well be required for future maintenance dredging and possible widening and deepening. However, because of the high priority now placed on marsh preservation, opposition to the continued use of marshes within the easement has been expressed by the EPA and other Federal agencies. At the suggestion of the EPA, each future dredging operation will be coordinated with that agency and other interested Federal and State agencies. The outcome of this coordination can not be determined at this time. The dilemma that will be encountered during this coordination is the expressed desire of EPA that all further use of marshes for the disposal of dredged material be discontinued, and the lack of funds for the State and Federal governments to achieve equal benefits by alternative dredging procedures. In view of the uncertainity about the disposal practices of future maintenance dredging work because of the recently adopted interagency coordination procedure, the discussion of environmental impacts of future dredging must be somewhat general.

4.01.1 A major impact of this maintenance dredging is related to effects on water quality and on the ecosystems within the waterway and disposal areas. Water quality is affected mainly by local short-term increases in turbidity and sedimentation of adjacent waters because of the bottom disturbance by the dredge cutterhead and the suspended and dissolved material in the effluent from the disposal areas. The effects on disposal areas include the smothering or displacement of resident plant and animal communities and the prevention of any substantial regrowth or recolonization to occur, as the area continues to be utilized as a disposal area.

4.01.2 The impact of dredging on the dredging site and on adjacent areas appears to be of short term duration and is of minor consequence when compared to environmental effects associated with disposal of dredged materials. As stated in Section 1.0, a pipeline

dredge is now [illegible] maintenance operations in the AIWW. With this type of [illegible], the impact on the dredging site proper involves the [illegible] the substratum and most of the sedentary or slow moving [illegible] in the substratum to the depth of the cut. The physical [illegible] disturbs surrounding sediments and creates minor turbidity through resuspension of sediment in the water column.

4.02 Water quality [illegible] mentioned above, it is characteristic of any hydraulic dredging operation that water turbidity in the vicinity of the dredge will increase as a result of the mechanical action of the dredge cutterhead. Observations of maintenance dredging in the AIWW indicate that there is a temporary increase in turbidity in the area of dredging and, although visible at the surface only in the immediate vicinity of the cutterhead, the subsurface plume may extend several hundred feet [illegible] upstream or downstream as determined by tidal currents. Some increases in turbidities may also be expected adjacent to the disposal areas, although the use of dikes and weirs greatly reduces the sediment content of the disposal area effluent. If barging of dredged material and ocean dumping are implemented, an increase in turbidity at ocean disposal sites can be expected.

4.02.01 Turbidity caused by the dredging operations can effect a short-term decrease in light penetration and a corresponding decrease in photosynthetic activity for waters at and downcurrent from the site (Cronin et al 1971). In addition, light intensity at the sediment-water interface of the newly deepened channel also will be decreased because of greater depth, thus reducing photosynthetic activity of recolonizing plants. Localized depletion of dissolved oxygen may be produced by [illegible] turbidity. A decrease in photosynthetic activity [illegible] amount of oxygen released by phytoplankton, and bacterial decomposition of resuspended organic particles and oxidation of [illegible] places a high demand on available dissolved oxygen.

4.02.02 In addition to [illegible] turbidities, the disturbance of bottom sediments [illegible] may release chemical substances, and possibly increase [illegible] and toxic substances. Sherk (1971) reviewed [illegible] these substances upon resuspension [illegible] and concluded that:

> [illegible] support the contention that [illegible] release, and possible release of toxic [illegible] water column with resuspension of [illegible] dredging, disposal and [illegible] during storms, during flood [illegible]

4.02.03 [illegible] decomposition of resuspended [illegible] the release of nutrients, including [illegible] would be most active [illegible] and would not extend [illegible]

4.03 Biological resources.

4.03.01 Benthic organisms. As discussed in Section 1.0, dredging of the AIWW is accomplished by hydraulic pipeline dredge. As is the case in most dredging projects, many of the benthic invertebrates in the immediate path of the dredge cutterhead will be destroyed. This gross effect has been well documented in many studies and field investigations conducted along both the Atlantic and Gulf coasts (Chesapeake Biological Laboratory, 1970; Sherk, 1971; and May, 1973) and can be expected to occur to some extent during the proposed dredging. Many impact assessments have assumed that this destruction eliminates the relatively immobile members of the benthic invertebrate community in the dredged area for an extended period of time, however, recent research indicates that this may not be a valid assumption. For example, in a 1973 study of Altamaha Sound, Georgia, researchers at the Skidaway Institute of Oceanography (A. D. Little, Inc., 1974) found that "...while the number of species, and especially the number of individuals per unit area were greatly reduced following dredging, several species were still present in some quantity. Recovery of the population to levels approaching those of the control stations appeared to be rapid. While this study suffers from lack of replication of sampling methods, it does provide an indication that the benthic community is able to quickly recover following dredging, and remains as a viable community both during and immediately after dredging operations are undertaken." The Skidaway Institute researchers hypothesized that rapid repopulation of benthic fauna in dredged areas may be due to: (1) suspension of many organisms in the water column with the turbulence created by the passing of the dredge, and subsequent resettling of some suspended organisms upon the dredged area, and (2) erosion or slumping of steep slopes of recently dredged channels, carrying benthic organisms into the channel in the process. Evidence of rapid repopulation of dredged areas in the Charleston Harbor estuary was found during recent trawling by personnel of the S. C. Wildlife and Marine Resources Department (MRD). During their January 1974 trawl sampling at a station off the Columbus Street terminal, the trawl net retained several chunks of bottom sediments from an area dredged less than one month prior to the sampling date. These benthic samples contained an abundance and diversity of worms (mostly polychaetes), mud crabs, and bivalve mollusks comparable to that of numerous preserved samples from various undredged areas later examined at MRD headquarters.

4.03.01.1 Considering the hydrographic framework and sediment sources in the area of the AIWW in South Carolina, it is most probable that newly dredged sites will continue to accumulate sediments similar to those previously removed. Thus, newly developed biotic communities, recruited from adjacent undisturbed areas, should approximate those lost during dredging. The time involved in recolonization and in the attainment of the particular stage of community succession previously achieved is dependent upon a complex of factors that will vary with locality. Under most conditions this recovery period will be from one to two years (Boyd et al. 1972).

4.03.01.2 No quantitative data are available on biotic recovery in dredged areas for South Carolina waters. Stickney (1972) reported on the recovery of bottom fish and motile bottom invertebrate fauna after dredging of the AIWW in Wilmington River and Ossabaw Sound near Savannah, Georgia. He was unable to demonstrate any effect of dredging on the seasonal occurrence, dominance or diversity of motile organisms inhabiting the channel. Sherk (1971), in describing the recovery of low salinity benthic communities in a 35 foot channel in Chesapeake Bay (1966-1970) stated:

> "One and one half years after dredging, the population (number of individuals) and species diversity in the disposal area were the same as those of the surrounding area. The channel area population remained lower, but in the same order of magnitude as before. However, the channel area did not recover in diversity. Benthic biomass in the channel area might always remain low because of the instability of bottom sediments."

4.03.01.3 This Chesapeake Bay channel is considerably deeper than the 12-foot channel authorized for the AIWW, but it is felt that the effects of dredging and subsequent biotic recovery in shallow channels will be similar to those observed in deeper waters. Therefore, it is expected that the overall long-term impact on benthic invertebrates will be insignificant.

4.03.02 Plankton. Resuspension of sediments and resulting turbidity have both adverse and beneficial impacts on phytoplankton and zooplankton.

4.03.02.1 Phytoplankton. Research conducted on the effects of dredging on phytoplankton populations in Charleston Harbor (Belle Baruch Coastal Research Institute, 1973) indicates that the effect of dredging on primary productivity is initially inhibatory due to increased turbidity. Recovery, however, takes place downstream. If nutrient supplies are increased, they could cause phytoplankton blooms which provide larger food supplies to primary consumers.

4.03.02.2 Zooplankton. It appears that zooplankton populations may be reduced somewhat during actual dredging operations due to mechanical destruction and possible anoxia. Suspended particles may block gills and food filters of larval fish, crabs, shrimp, and the planktonic larvae of marine invertebrates. The area affected is comparatively small and effects decrease rapidly with distance from the dredging operation. Therefore, the long-term productivity of planktonic organisms will not be significantly affected by the continued maintenance dredging of the AIWW.

4.03.03 Fish and commercial and sport fisheries. Much of the AIWW in South Carolina borders upon or traverses valuable fishery grounds, including shrimp nursery areas, oyster beds, blue crab grounds, and finfish habitats and migration routes.

4.03.03.1 Available data indicate that fish populations, unlike benthic invertebrates which are relatively immobile and may undergo population reductions that may be locally severe, are less likely to be adversely affected by dredging operations. For example, Stickney (1973) in his study of the Atlantic Intracoastal Waterway in Georgia found no indication of fishes being killed during dredging operations. In some areas, dredging could even be considered to be beneficial to certain species of fish, especially those which prey on the larger benthic organisms. As a dredge works its way along a channel, benthic animals which would normally be buried in the sediments are dislodged and become susceptible to predation. This sudden availability of food quite often results in higher than normal concentrations of fishes near the dredge. Deep water or ocean disposal could create a similar situation.

4.03.03.2 Although it would appear that fish are relatively unaffected by dredging, there has been some concern in the last few years over the possible effects of increased turbidities and siltation associated with dredging. As a dredge moves along the channel, it invariably creates some type of turbidity plume, the size of which will vary considerably depending on the type of sediment being dredged, strength of currents and other factors. The magnitude of the impact of suspended particles on fishes will, in most cases, be dependent on the concentration, composition, absorbed minerals or toxins and the tolerance of particular species. In general, bottom-dwelling species are the most tolerant of suspended solids, filter feeders are most sensitive and juvenile forms are more sensitive than adults.

4.03.03.3 Sherk and Cronin (1970) found that under experimental conditions, fish subjected to extremely high concentrations of suspended soils have died from suffocation due to clogging of the gills and opercular cavities. Under normal circumstances, fish can generally avoid turbid waters and have the ability to clear gill membranes of accumulated silt upon entering undisturbed water. However, not all species are equally susceptible to suspended solids and different suspended solids vary in their effect. As a general rule, it has been found that fish can tolerate high turbidities except when they are accompanied by low levels of dissolved oxygen, acids, alkalies, or other substances which interfere with respiration, injure gills or prevent their normal function, and they are quite capable of leaving the immediate dredging area.

4.03.03.4 Turbidity plumes created by the proposed project will primarily be restricted to the immediate dredging area. Fish species which would have the highest probability of being affected are the filter feeders (primarily menhaden, herring, and shad) and juvenile forms. Estimates of the relative abundance of these species in the AIWW at any given time varies so that it is not practical to attempt a quantitative determination of the impact on these species. In addition, some larval fishes will be destroyed either

as a result of the mechanical action of the dredge, being exposed to turbid water, or being exposed to toxic substances in sediments. However, based on [illegible] which has been accomplished in other areas and available information on the effects of current dredging practices in the waterway, it is felt that any impact resulting from the proposed maintenance dredging will be of a short-term, localized nature and will not significantly affect the fish stocks in the waterway or the organisms which it traverses.

4.03.02. [illegible] commercial species harvested along the AIWW include shrimp, [illegible], oysters, clams, blue crabs, American eels, [illegible]. [illegible] these species are [illegible] offshore fisheries which will not be directly affected by [illegible] dredging. Oysters and clams, most of which are found in shallower areas, will not be significantly affected by [illegible] in clear and turbid waters. Most of the oysters along the AIWW are in creeks and are not found immediately adjacent to the channel. The suspended materials from dredging operations are not expected to smother these oysters in concentrations significantly greater than those normally encountered from wave action and other turbulence. Shrimp and blue crabs are found throughout the [illegible] and, although, quantitative data are available, there is a definite possibility that some will be killed if they come in contact with the [illegible]. Although numbers destroyed could be quite large, the [illegible] and will not significantly affect [illegible] these fisheries. Many of the commercial and sport fish [illegible] and a portion of their life cycle in the estuaries traversed by the AIWW [illegible] adversely affected by turbidities or [illegible] associated with dredging. The impact on these [illegible] is considered insignificant.

4.03.03. [illegible]. The EIS presents information on marsh preservation [illegible] incentive and justification for reducing to the extent practicable the use of marshes for the disposal of dredged [illegible] modification of all future dredging work which was discussed in Section 1 of this EIS has been adopted for [illegible].

[illegible] areas used as disposal [illegible] elevation exceeds [illegible] is no [illegible] of the deposition of [illegible] the character- [illegible] black [illegible], cattails eventually [illegible] silverling, and wax myrtle. [illegible] a permanent loss [illegible] operation.

4.03.04. [illegible] portion of the [illegible] as [illegible] estuarine or near- [illegible] crabs, blue [illegible] [illegible] the functional

importance of marsh extends beyond its intrinsic potential biological productivity. While it is recognized that these marshes play an important role as a nursery area in the life cycle of many species, this role has not been quantified to the extent that its effect can be described on a per acre basis. However, any further diking of marsh for the disposal of dredged material would represent an additional loss of important habitat for these species.

4.03.04.3 Shorebirds, waterfowl, gulls, herons, plovers, dowitchers, sandpipers, clapper rails, red-winged blackbirds, grackles, sparrows, and marsh hawks will be displaced to a large extent from marshes during their conversion to an upland environment. Mammals such as the raccoon, opossum, marsh rabbit, and various rodents will continue to use disposal areas although their habitat value may be reduced. After shrubs and small trees become established, small birds such as sparrows, red-winged blackbirds, grackles, small rodents and marsh hawks will return. Occasional uses of disposal areas include the establishment by herons, egrets, and ibises of rookeries such as those on each end of Drum Island in Charleston Harbor. Other ground nesting birds such as certain species of tern, black skimmers, and gulls nest on islands created by open water disposal operations.

4.03.05 Beach, dune, and maritime shrub thicket. These communities are found along most of the South Carolina coast as a narrow zone bordered on one side by water and on the other by marsh. Because of the high value now being placed on marshes, it is considered unlikely that new disposal areas in the marsh zone will be acquired when existing areas are depleted. It is also unlikely that the beach, dune and maritime shrub thicket will be affected by future maintenance dredging since it is not practical from an economic and engineering viewpoint to build diked disposal areas that are totally confined to the beach or dune area. Additionally, very few shoal areas on the waterway are composed of materials which would be suitable for beach nourishment.

4.03.06 Urbanized land. The use of urbanized areas does not appear practical because such a use would be incompatible with human use of adjacent areas. The cost of urbanized property also would deter its use for this purpose.

4.03.07 Woodlands. As discussed in Section 2.0, several types of woodlands are found on the uplands along the waterway. It now appears that these wooded uplands are the most likely areas to be selected for disposal of dredged material when the currently used disposal areas are used to capacity. Woodlands are one of the largest environmental types in many areas along the waterway and the rationale for preservation of individual tracts of marsh does not apply to these woodlands. Woodlands are also less expensive than urbanized areas and would, therefore, be more suitable from the project sponsors viewpoint.

4.03.07.1 Prior to the use of any wooded tract of land, the owner would probably remove merchantable timber. In any event, dense stands would be removed to permit a more even distribution throughout the disposal area of the hydraulically dredged material. Any trees not removed and all understory plants would be killed when their roots become covered to a sufficient depth. Vegetative regrowth would consist probably of poke berry and other herbs and shrubs such as silverling and wax myrtle, and trees of most of the same species growing prior to dredging.

4.03.07.2 Practically all significant animal life except for some small birds would be displaced during and shortly after the use of a wooded disposal area. Raccoons, opossum, and some small rodents might continue to forage without interruption in the disposal area. As vegetative regrowth begins, foraging by the other species that were displaced during the preparation and clearing and subsequent use of the area will increase. Plant and animal life will fluctuate from a low during and shortly after deposition of dredged material to a high just before a dredging operation. When capacity has been reached, a reversion to a wooded state by sweetgum, pines, hackberry, oaks and other upland species will occur unless man's activities intervene through use of the area for cultivation or residential or other development. Material dredged from many areas is well suited for farming.

4.03.08 Agricultural land. Agricultural lands, along with woodlands, appear to be one of the most likely areas to be selected for the disposal of dredged material when the currently used disposal areas are used to capacity. Agricultural lands are one of the smaller categories of land use but some of the basic restrictions operating against the selection of marsh and urbanized areas referred to earlier do not apply.

4.03.08.1 The impact on wildlife of using cultivated land for the disposal of dredged material depends on the length of time since the land was last cultivated. Recently cultivated land usually has very little utility for wildlife because of the common practice of clean farming, and the use of such an area for disposal would have little impact on wildlife. Fields that are left fallow for some time provide habitat for a number of small animals as discussed in Section 2.09.05. Most of these would be displaced by dredged material. Vegetative regrowth would begin shortly after the area dries with pioneer species such as poke berry, and other herbs and grasses being the first to appear. Shrubs such as silverling and wax myrtle and trees such as sweetgum and sassafras would appear shortly afterwards. As vegetative regrowth progresses, foraging by animals displaced during dredging will increase. The extent of this foraging will also depend on the quality of adjacent habitat. If such a disposal area were bordered by woods, a greater diversity of animal life might forage in the disposal area than if it were bordered by cultivated

4.03.08 Plant and animal life will fluctuate from a low during and immediately after deposition of dredged material to a high just before a dredging operation. When capacity has been reached, a reversion to a climax state by sweetgum, pines, hackberry, oaks, and other upland species will occur unless cultivation is resumed or the area is placed in residential or other development. The dredged material in many areas is very well suited for farming and has been so used on Cat Island and South Island near Georgetown and this land could be used as productive farmland once capacity has been reached.

4.03.09 Rare and endangered species.

4.03.09.1 Rare and endangered animal species. There are several endangered species known to be present, at various times, in various areas along the AIWW (See Section 2.09.06.1). To the extent that upland sites are used in lieu of marshlands, those species using uplands near rivers and coastal bays could experience some loss of habitat. There is no reason to believe that the other species listed would be affected by continued maintenance of project channels. The cooperative interagency efforts described in Sections 1.04.01 and 1.04.03 should prevent excessive loss of this habitat where crucial to rare and endangered species.

4.03.09.2 Rare and endangered plant species. Maintenance of the AIWW will not affect any of the threatened species listed in Section 2.09.07 during dredging or disposal at existing sites. The cooperative interagency efforts described in Sections 1.04.01 and 1.04.03 should prevent the choice of new upland sites crucial to the survival of these plants.

4.03.10 Mosquitoes. The use of diked disposal areas to avoid adverse effects of estuarine values has an adverse effect in that diking in the coastal zone creates ideal habitat for mosquitoes, particularly the salt marsh mosquito, Aedes sollicitans. Other mosquitoes likely to be associated with this habitat are Aedes taeniorhychus and Psorophora columbiae. Characteristics of diked disposal areas that make such areas productive of mosquitoes are the elimination of regular tidal flooding and the temporary ponding of water due to uneven settling of dredged material and poor drainage. The cracks that normally form during the drying of disposal areas provide very favorable oviposition sites. Natural controls such as the maintenance of stable water levels or the achievement of rapid drainage would greatly limit the production of mosquitoes in disposal areas, but neither method appears practical because of physical characteristics of the disposal areas and material dredged from the waterway and also because of operational requirements of disposal areas. Mosquito breeding in disposal areas was not anticipated when the AIWW was authorized by Congress as there were no provisions made for mosquito control. The association of disposal areas with mosquito production was first brought to the attention of the Corps by Charleston County officials in the summer of 1972. Although the Corps has since funded research on mosquito production and control in disposal areas, it asked the S. C. Water Resources Commission as the representative of the project sponsor to assume the control of mosquitoes as a requirement of project sponsorship. However, since the State is unwilling to assume this cost, the Charleston District will in the future contribute to the cost of county or state comprehensive mosquito control programs which include disposal areas that provide breeding sites for mosquitoes. The Federal cost will be proportionate to the contribution of disposal areas to the mosquito problem. The most commonly used insecticide is Flit M.L.O., an oil larvicide which dissipates quickly and has no effect on important forms of aquatic life. Since Flit has no residual effect, a control program utilizing oil larvicides requires frequent inspections and spraying.

4.04 Archaeological and historical sites. Continued dredging activities in the South Carolina AIWW would have no impact on archaeological or historical resources. Since the completion of the project in the 1940's, maintenance dredging has been a regularly occurring event and it is highly unlikely that continued maintenance would disturb anything of historic value. The selection of new disposal areas will be coordinated with the State Historic Preservation Officer and State Archaeologist to minimize potential damage to sites of historical or archaeological interest in those areas. The National Register of Historic Places has been consulted and it has been determined that no Register properties will be affected by continued maintenance dredging.

4.05 Aesthetics. Prior to the actual dredging, the dikes inclosing the disposal areas must be raised by use of material from within the diked disposal area. These dikes will consist mainly of barren earth which will contrast in an unfavorable manner with surrounding areas that are fully vegetated. A barren appearance within the disposal area will also prevail for some time after dredging. Natural vegetative regrowth on the dikes and within the disposal areas will commence soon after dredging is completed and a relatively full vegetative cover of grasses and herbs may be achieved within a few months. The attainment of a full vegetative cover will present a more natural appearance to the diked disposal areas, and will restore to some extent the aesthetic values that were lost during the dredging operation. The presence of the dredge boat and pipelines and associated equipment in the waterway will represent an intrusion upon the view of the waterway during the period of dredging. This impact would exist only during dredging and is considered of lesser magnitude than the aesthetic impact associated with the disposal of dredged material in diked disposal areas.

4.06 Noise and air quality. Operating dredges are usually quiet. They contribute less to ambient noise levels than does normal waterway traffic, and far less than motor and speed boat traffic. Air and water pollution derived from dredge engine exhaust is negligible, especially when assessed as a percentage of that produced by normal commercial and recreational traffic.

4.07 Socio-economic conditions. Maintenance of the AIWW in South Carolina is essential to the continuation of a protected coastal route for commercial and recreational vessels. Much of present traffic in South Carolina waters originates and terminates out-of-state, but current trends towards increased urbanization and industrialization in coastal South Carolina undoubtedly will result in larger volumes of locally generated traffic. Whether continued availability of the AIWW will have a significant effect on economic growth in South Carolina and in adjacent states is unknown, but its absence would severely hinder movement of goods, increase transportation costs, and subject recreational craft to the hazards of open sea routes.

4.07.01 The impact of future maintenance dredging on commercial and sports fishing industries cannot be qualified at this time. Marshes

play an important role in fisheries production, and their use as disposal areas ultimately results in their conversion to an upland environment with little contribution to fisheries production. The indefinite continuation of the use of marshes for the disposal of dredged material is considered unlikely. However, any further use of marshes for this purpose would diminish fishery production to an unknown extent.

5.0 Any Probable Adverse Environmental Effects Which Cannot Be Avoided

5.01 A detailed discussion of all environmental impacts expected to result from the project is contained in Section 4.0. Some of these impacts are considered unfavorable, but cannot be avoided by any practical means within the authority and scope of the proposed project.

5.02 The principal adverse impact of the continued maintenance dredging of the AIWW is associated with the use of marshes for the disposal of dredged material. The affected marshes are converted into an upland environment resulting in a complete loss of their contribution to estuarine and marine fisheries production. Although these losses are unavoidable when marshes are used for the disposal of dredged material, there are alternatives to marsh use, such as use of woodlands, pasturelands, or offshore disposal which would not significantly affect estuarine and marine productivity. Sections 1.04.02 and 1.04.03 indicate the intent of the Corps to discontinue the use of marsh as disposal sites except where no alternatives are available and the benefits from such disposal outweigh all adverse impacts.

5.03 Maintenance dredging of the AIWW will temporarily affect water quality and aquatic life in the channel and associated water areas. These effects include: increased turbidities and siltation in the vicinity of the dredge and disposal areas; a temporary decrease in primary productivity resulting from turbid waters reducing the euphotic zone; a possible loss of organisms through the release of toxic substances and a possible reduction in dissolved oxygen levels as a result of the dredge disturbing organic materials undergoing anaerobic decomposition.

5.03.01 In addition, some benthic organisms may be destroyed by the dredge cutterhead. Wildlife species inhabiting the disposal areas will be displaced by deposition of dredged materials. Existing vegetation in disposal areas will be covered by dredged materials each time the area is used for disposal. Regrowth usually begins soon after dredging is completed. Diking in the coastal area creates ideal mosquito habitat.

6.0 Alternatives to the Proposed Action

No action. The no action alternative requires that further maintenance dredging be performed on the AIWW. Areas of shoal rapidly would soon become too shallow for commercial

traffic and the larger recreational craft. As soon as the first shoal becomes non-navigable to commercial and larger recreational craft, the effectiveness of the AIWW as a continuous transportation link and as a local connector between ports and inlets would be lost. As additional areas shoal up, the waterway would begin to lose usefulness to even short-haul recreational traffic. This alternative was rejected because the project benefits are believed to outweigh the adverse environmental impacts that would result from continued maintenance of the project. (See Section 1.03).

6.02 Relocation of disposal areas. Advantages and disadvantages of alternate disposal sites are discussed in the Sections below. Costs for pumping of dredged material to the sites would vary according to the estimated figures below. Actual pipeline pumping costs would be similar for all four types of disposal sites. The pumping distances that appear in the table below are linear feet of pipeline laid, and do not necessarily represent a distance perpendicular from the AIWW. In order to avoid severe mobilization and demobilization problems with pipelines, and in order to minimize the acres of disposal area required, the pipeline trails for some distance behind the dredge as it moves along the narrow channel.

Estimated Cost Per Cubic Yard for Maintenance Dredging of the AIWW Between Little River and Port Royal, S. C.

Average Pumping Distance (ft.)	Estimated Cost Per Cubic Yard
Up to 4,000	$0.75
8,000	1.20
12,000	1.35
20,000	2.00
30,000	2.85

In addition to pumping costs, upland sites would require dikes at an average of roughly $8,000 to $10,000 for each shoal. Disposal area preparation costs for beach, ocean or open inland water sites would be minimal.

6.02.01 Alternate upland sites. The use of upland disposal areas, possibly in conjunction with disposal in the ocean, on the ocean beach, or in shallow water to build new marsh, has been recommended as an alternative to the continued use of the 1,000-foot easement provided by the State. The State would have the responsibility of acquiring any alternative disposal areas. This alternative may be adopted for dredging some segments of the waterway, but since its adoption requires the acquisition of new easements by the State, the extent of its future use cannot be determined at this time. The substitution of upland disposal sites for marsh sites would avoid the adverse impacts on estuarine and marine productivity attributed

to the currently used disposal procedure. The major problem with implementing this alternative is its great economic cost. The State would be required to pay the cost of acquiring new easements on the uplands to be used for the disposal of dredged material and the Federal government would incur additional dredging costs because of the increased pumping distances. (See Section 6.02). All existing vegetation in these upland disposal areas would be killed and those areas would lose what value they may have as wildlife habitat. Since each area may be used for some years, this loss represents a fairly long-term commitment, but upland habitat is a common habitat throughout the State and its loss is not considered significant. When filled to capacity, these areas may be devoted to agriculture or residential or other human development. If not subjected to further human use, these upland disposal areas will become revegetated naturally with poke berry and other herbs and shrubs such as silverling and wax myrtle, and eventually tree growth similar to that growing on adjacent uplands. The future reliance on this and other feasible alternatives could vary from year to year in response to variables such as shoal location and practicality of other alternatives.

6.02.02 Open water disposal. This alternative involves the disposal of dredged material in open water areas in such a manner as to elevate the bottom to an intertidal level so as to encourage the growth of smooth cordgrass. This alternative is still in the experimental stage. Under favorable conditions, it could be a highly beneficial use of dredged material and will continue to be used and evaluated on a trial basis. This alternative would require the conversion of productive water bottoms to marshes having a higher productivity. It would also temporarily reduce water quality by increasing water turbidity and the concentration of any pollutants that might be in the dredged material and decreasing dissolved oxygen through the oxidation of organic materials resuspended in the water column. Since areas suitable for creating new marsh have not been delineated, the extent to which this alternative could be relied upon has not been determined. Because shallow open water areas also possess a unique value, unrestrained use of this method is not proposed.

6.02.03 Beach disposal. This alternative involves the deposition of dredged material in unconfined ocean-beach areas. This alternative would avoid significant environmental damage to highly productive areas such as marshes and associated water bottoms. It would also renourish beaches that are continually eroding. This reversal of the erosion process also protects the marshes that normally lie behind the beaches. Benthic communities in the disposal zone would be temporarily disrupted and possibly altered in response to changes in the composition of bottom materials. Beach disposal would cost more than current disposal procedures because of the greater pumping distance required. Most of the material dredged from the waterway consists of silt and clay and does not make good beach nourishment material because it is very erodable and also leads to high water turbidity. This alternative may be found preferable in certain circumstances to other alternatives and will be considered in future dredging operations.

6.02.04 Ocean disposal. This alternative differs from the beach disposal alternative in that the dredged material would be pumped or conveyed in barges beyond the beach zone the additional distance to the ocean disposal site. Ocean disposal would avoid significant environmental damage to highly productive areas such as marshes and associated water bottoms. Benthic communities in the disposal zone would be temporarily disrupted and possibly altered in response to changes in the composition of bottom materials. However, the disposal sites would be selected so as to minimize the adverse effect on the disposal site and vicinity. Ocean disposal by pipeline does not appear economically feasible at this time because of high costs attributable to the great pumping distances required. An 18" pipeline dredge (largest dredge commonly used on the AIWW) is most efficient and economical at pumping distances up to about 5,000 feet. When the pumping distance exceeds 5,000 feet, the dredge production begins to drop and the cost of the dredging rises accordingly. When the pumping distance exceeds about 10,000 feet a booster pump must be added to the pipeline and an additional booster pump for each additional 10,000 feet of pipeline. Each booster pump added will increase the cost of the pipeline dredge by about one fourth. A similar alternative, beach disposal, would be cheaper because of shorter pumping distances required and would appear feasible in all locations suitable for ocean disposal. Despite increased costs since the estimates for barging material to ocean disposal sites were made in 1970, this method could still prove economically attractive if the special dredge described in Section 1.05.2 were available. The special dredge allows materials with considerably less water content than necessary for conventional dredges to be removed from channel bottoms and placed on adjacent barges. The lower water content results in a volume of dredged mixture approximately one fourth the volume that would be required with conventional methods.

7.0 The Relationship Between Local Short-term Uses of Man's Environment and the Maintenance and Enhancement of Long-term Productivity.

7.01 The principal short-term uses of man's environment include the maintenance dredging of the AIWW to provide a continuous sheltered waterway for commercial shipping and recreational boating. The benefits derived from commercial shipping also have a bearing on long-term productivity from the standpoint of human welfare. If the AIWW were abandoned, net human productivity would decline because of the higher cost of alternative shipping methods.

7.02 The natural long-term productivity of the estuarine and marine environment is affected to an undetermined extent by the conversion of marsh to uplands as a result of the use of marsh for the disposal of dredged material. Because the interactions of other factors bearing on estuarine and marine productivity have not been quantified, the net effect of the project-related reduction in marsh acreage on long-term productivity of the estuarine and marine environ-

ment is not known. After diked sites now in use are filled to capacity, the use of marsh, if any, will be limited to areas where no reasonable alternative methods of disposal are available, and where the benefits can be demonstrated to be greater than all adverse impacts. A small amount of marsh use could be partially offset by newly created marsh. The intentional use of dredged material to create new marsh is one of the alternatives that will be considered in future evaluations of specific dredging operations.

7.03 Because of the interagency coordination of all future dredging work, there is some uncertainity about the nature of future disposal operations. However, the authority of the EPA regarding the disposal of dredged material in navigable waters has increased significantly. This new authority together with EPA's assertion that approval of marsh disposal sites will not be granted indicates that marshes will be used to a much lesser extent than at present for the disposal of dredged material. Consequently, the adverse effect of project maintenance on long-term productivity of the estuarine and marine environment which was described in the preceeding paragraph may not apply to future disposal operations.

8.0 Any Irreversible And Irretrievable Commitments Of Resources Which Would Be Involved In The Proposed Action

Disposal areas will be altered as has been described in Section 4, but such changes are not considered irreversible except in the case of marsh disposal sites. The conversion of marsh to uplands is for all practical purposes, irretrievable. As is discussed in Section 6, EPA's authority in regulating the disposal of dredged material in navigable waters, which includes disposal in marshes, is expected to lead to greater reliance on other dredging alternatives in future dredging operations. Marsh can be created with dredged material and this is one of the alternatives that will be considered in future dredging operations. Implementation of this alternative would offset prior commitments of marsh resources made when marsh was used for dredged material disposal and converted into an upland environment. The continued maintenance of the waterway requires an irretrievable commitment of the fuel and labor.

9.0 COORDINATION AND COMMENT AND RESPONSE

A draft EIS was distributed for review September 15, 1975. Letters of comment are attached to this EIS in Appendix A. A circled number follows each comment which requires a response. A corresponding number was assigned to the appropriate response. Responses to these letters of comment are contained in the following two sections.

9.01 Government Agencies.

U. S. Department of Agriculture, Forest Service

1. This comment, when compared to comment 4 by EPA and related comments on similar project, exemplifies the conflict among viewpoints expressed by Federal agencies, state agencies, citizen groups and individuals. Land use is a basic issue and requires both cooperation and concession from the various agencies and groups involved. For this reason we have suggested the interagency selection process described in Section 1.04.01 and 1.04.02 for choosing new disposal sites. Existing diked sites will be used until filled to capacity.

2. We will coordinate with the South Carolina State Commission of Forestry in the selection and use of wooded sites for future disposal areas.

U. S. Department of Agriculture, Soil Conservation Service

No comment required.

U. S. Department of the Interior

1. See revision to Section 2.07.02.1.

2. The commercial importance of shrimp was emphasized in Section 2.11.02.2 and Table 7 of the Draft EIS. The vital role of shrimp in estuarine ecology was mentioned in Section 2.09.04.2.1. See addition to this section.

3. We concur that the project should not have any effect on minerals of commercial importance. Peat and mica were added to the list of mineral resources in Section 2.04.09. Cement and vermiculite, which are commercial preparations, were not added. The others were already listed in the Draft EIS.

4. See addition to Section 2.11.02.3.1.

5. SCORP will be consulted for any actions that affect recreation.

6. This consideration is covered in Section 1.04. See also responses to letters of the State Archaeologist and State Historic Preservation Office.

7. These comments are included in Appendix A.

8. The subject EIS addresses all the significant impacts anticipated from any future work. In the event that an action is planned which causes significant impacts not considered in the subject EIS, a supplement will be prepared.

U. S. Environmental Protection Agency

1. We will make use of the general sentiments comprising the Interim Final Guidelines. More specific guidelines in regard to standards for sediment analysis, eleutriate tests and water quality would be helpful. In particular, methods, criteria and acceptable concentrations of pollutants as called for in P. L. 92-500, Section 404b and 403 (c) (1) (E) would be valuable in applying the general environmental considerations listed in the guidelines.

2. This information was prominently displayed in Table 2 and Sections 1.03 through 1.03.16 of the Draft EIS, and is retained in the Final EIS.

3. See Sections 1.04, 1.04.1 and 1.04.2.

4. See added Section 1.04.

5. Both procedures were included in the Draft EIS and have been retained in the Final EIS.

6. Both procedures were included in the Draft EIS and have been retained in the Final EIS.

7. Conflicting opinions as to preferred alternate methods (see response to comment 1 of the U. S. Forest Service and response to S. C. Land Resource Commission) will require disposal sites to be selected on a case-by-case basis, as described in Section 1.04.2 of the EIS.

U. S. Department of Commerce

1. The general comments by DOC suffer from the same lack of specificity that they criticize, and make precise response to this paragraph difficult. In this response and those which follow, an effort has been made to answer all comments which are concisely stated and to extract the principle concern from those comments which are unclear. In regard to the disposal sites to be used over the life of the project, see Section 1.04. The original easements for disposal were obtained by the local sponsor at a time when little concern was expressed by government agencies or individuals for the now appreciated values of wetlands. As can be seen in the conflicting recommendations for disposal by various agencies in this EIS, no one method of disposal is devoid of environmental impacts. Further, preferences for disposal methods expressed by cognizant agencies have varied over a period of time and from one project to another. Clearly, land use is at issue. Because of the wide geographical area of the subject project and the long period during which maintenance will be required, a cooperative selection process as described in Sections 1.04.2 and 1.04.3 is felt to be the best approach for avoiding adverse impacts as they are now anticipated and as they are further appreciated in the future.

2. See response to comment 6 below.

3. Section 2.09.04.3 of the Draft EIS discusses specifically the role of tidal flats in cycling energy, both from non-vascular plants and from detritus from vascular plants brought to the flats by tidal action. The link to benthic invertebrates, fish and birds is also clearly stated.

4. (a) This possible lower diversity was stated and referenced in the Draft EIS.

(b) Loss of stability and resultant long-term damage to the community while plausible, was not documented in the study cited in the Draft EIS. As no documentation was provided by DOC for this comment, it was not included in the Final EIS. See also pertinent portions of 4 (c) below.

(c) See addition to Section 4.03.01. The settlement described by DOC in this comment is a classical, textbook example and bears little resemblence to the factors at work immediately following dredging operations. Slumping of steep slopes and resettlement of organisms suspended by action of the cutterhead are not strongly dependent on such factors as biological attractants, light intensity, etc.

(d) No evidence was presented in the Draft EIS which demonstrates that benthic communities will not be adversely affected because this is not our contention or that described by the several references cited. Clearly, some adverse effects will occur to benthic communities. All evidence available to this office indicates that these effects are of short duration or are not severe.

5. We have no evidence that effects may prove deleterious to fish by reducing food sources over the long range. We can not include this supposition in the Final EIS without supporting data.

6. Many of the assumptions in the article cited by DOC were oversimplified, such as the assumptions that all nutrients from secondary treatment would reach marsh-estuary areas (Table 4) or that all of the nutrients which pass through marshes are removed (Table 5). Unlike a true tertiary treatment system, which has little dissolved nutrient in the effluent, marsh-estuary areas owe a great deal of nutrient removal to simple flushing action. Nor is that portion assimilated by marsh 100% effectively removed from the system. Some nutrients are returned as dissolved organic nutrients. This is valuable to the estuarine biota, but does not constitute true tertiary treatment.

7. Paragraph 5.01 begins with the statement that detailed discussion of impacts is contained in Section 4.0. Repetition in this Section was not thought to be necessary. Without more specific reference to the unfavorable impacts alluded to by DOC, we are unable to respond further to this comment.

8. As stated in the Draft EIS, most of the material dredged from the waterway consists of silt and clay, and is not suitable for most construction and industrial purposes. Some of the more sandy soils are now being removed from disposal areas for fill or beach disposal. This limited use will continue in the future. Use of the more plastic materials for making bricks has been shown to be feasible, but not economically attractive when costs for transportation and processing are included. Dredged materials are now used for agricultural purposes near Georgetown and on Daniel Island. Dredged materials from more saline areas would require treatment before it could be used for many agricultural purposes. As yet, sufficient demand for these materials has not been demonstrated to consider removal from upland sites for these purposes as a major alternative to upland disposal.

9. The value of tidal flats was discussed in Section 2.09.04.3 and the value of shallow open waters was discussed in Section 2.09.04.1. The Draft EIS contains prominent mention of these habitats and their link between plant matter and higher aquatic organisms. While creation of marsh is feasible, unrestrained construction of marsh would be biologically undesirable. A marsh to shoal water area ratio of about 2:1 now exists in South Carolina. The cooperative selection process of future disposal areas should preclude any large deviation from this ratio or adverse effects to a particular local area. No supporting data was offered by DOC to indicate (a) that marshes constructed with dredged material are less productive than natural marsh systems, or (b) that an increase in man-made marshes would not increase productivity. These opinions were, therefore, not included in the Final EIS.

Federal Power Commission

No comment required.

U. S. Department of Transportation

No comment required.

U. S. Department of Housing and Urban Development

No comment required.

U. S. Department of Health, Education and Welfare, Region IV

No comment required.

Department of Health, Education and Welfare, Public Health Service

1. Because diking interferes with natural drainage, it is considered to be a major factor in mosquito production of disposal areas.

2. Although the nature of dredged material appears to preclude the use of harrow and disc, field tests of riverine utility craft were recently conducted in disposal areas at Charleston. Insufficient time has elasped to permit an evaluation of these tests.

3. Sections 1 and 4 of this EIS have been revised to show the assumption by the Charleston District of a proportionate cost of mosquito control on disposal areas when such areas are included in a county or state comprehensive mosquito control program.

4. See additions to Section 4.03.10.

State Land Resources Conservation Commission

1. We acknowledge the Commission's recommendation that upland sites not be used. We agree that if materials were disposed on farmlands, landowners would at least temporarily be denied access to crop-providing soils. Upland sites were requested from the local sponsor because, if correctly chosen, they would represent less ecologically valuable areas than the wetlands used in past years. Upland sites need not be farmland. The conflicting desires of various agencies and groups can be best handled on a case-by-case selection of sites as described in Sections 4.01.2 and 4.01.3

S. C. Wildlife and Marine Resources Department

1. See revision to Section 2.09.02.2.

2. See revision to Section 2.09.04.2.1.

3. Inclusion of these two forms has been made in Section 2.09.04.2.7.

4. Addition made as requested.

5. See revision to Section 4.03.04.2. Emphasis is placed on estuaries, as the intent of this section is to document the importance of marsh with respect to habitat and the significant of its loss.

S. C. Department of Archives and History

1. The Corps will contact the Department of Archives and History in regard to future upland disposal sites.

State Archaeologist

1. All sites of archaeological value known to this office were listed in the Draft EIS. Since the "other significant sites" alluded to in this comment were not specified, we were unable to include these sites in the Final EIS or begin plans for mitigating possible damage. Maintenance of the subject project has been authorized to its present depth of 12 feet

since 1937. Dredging to this depth has repeatedly disturbed this bottom. Archaeological finds, except those which may have been washed in since the previous dredging, are unlikely. Similarly, diked disposal sites now in use are located on former marsh and are under several feet of dredged material.

2. An archaeological survey will be conducted on any new disposal sites selected by the method described in Section 1.04.1. Also, a meeting with the Corps and the State Archaeologist has been scheduled to consider the need for survey of archaeological sites along the AIWW which may be subject to damage from channel maintenance. Archaeological clearance is not required for this project.

S. C. Department of Health and Environmental Control, Division of Vector Control

Sections 1 and 4 of the EIS have been revised to show the assumption by the Charleston District of a proportionate cost of mosquito control on disposal areas when such areas are included in a county or state comprehensive mosquito control program.

S. C. Department of Health and Environmental Control, Programs Development Division

1. Consideration was given to the importance of flushing of marsh areas in Section 2.09.04.2. The Corps has expressed its intent to use disposal areas other than marsh except where no reasonable alternate method is available and where the adverse effects of such use are clearly exceeded by the benefits of such use. The choice of future sites by the selective process described in Section 1.04.03 should prevent the adverse effects described in this comment.

2. Without more specific reference to the statements to which this comment is directed, a precise response is difficult. Table 2 gives a breakdown by shoal area of the quantity of dredging necessary and the frequency of dredging at that shoal. This information was contained in the Draft EIS and has been retained in the Final EIS. Although many of the impacts

related to action of the cutterhead and turbidity are of short-term duration, others such as diversity of benthic invertebrates in the channel were described as possibly extending over longer periods.

3. See revision to Section 4.03.03.5.

4. The disposal of dredged materials will be handled according to 40 FR 41292-41298, "Navigable Waters, Discharge of Dredged or Fill Material". Until more detailed guidance is available from EPA, each new disposal site will be chosen by the process mentioned above.

9.02 Citizens and citizen groups.

Environmental Defense Fund, Letter of 28 October 1975

1. Justification for a channel depth of 12 feet was made prior to the authorization of the deepening to this depth in 1937. See Section 1.03. A channel depth of 12 feet was not chosen arbitrarily as implied in these comments. In 1937, based on an engineering and economic analysis, authorization was given for deepening to 12 feet. Engineering design of channels involves more than the simple vessel draft - channel depth relationship proposed by EDF in this comment. Additional bottom clearance is required for safety, maneuverability and "squat", the lowering of the stern of a vessel due to propulsion. The ability of a large vessel to maneuver is impaired by narrow channel widths and slight bottom clearance. Ease of maneuverability is increased with channel depth. Drag on vessels due to the confines of channel dimensions reduces efficiency of movement and adds to transportation costs. An in-depth discussion of engineering channel design is not within the scope of this EIS. Further information is contained in chapter X of the report "Design of Channels for Navigation", McAleer, Wicken and Johnson, from Report No. 3, Evaluation of Present State of Factors Affecting Tidal Hydraulics and Related Phenomena, C. F. Wicker, Editor, Corps of Engineers. U. S. Army, May, 1965.

2. The project requires a continuous depth of 12 feet to receive all the benefits authorized in the 1937 Rivers and Harbors Committee Document No. 6, 75th Congress, 1st Session. Because silting and shoaling occur, depths measured at certain times during the year are less than 12 feet. It does not logically follow that because traffic has navigated these shoal areas, they should be allowed to remain and that other areas should be allowed to fill in to this depth. Vessels can be frequently observed churning mud in short segments of the AIWW between Charleston and Georgetown. In these areas the AIWW is obviously not providing the safety, maneuverability and efficiency authorized in the 1937 Rivers and Harbors document. Problem areas are dredged as frequently as permitted by the funds and dredging equipment available. Neither premise suggested in comment 5, concerning "controlling dimensions" is correct. The controlling dimensions are not a constant existing depth which can be used as a guide for channel design. Nor are they depths necessary to meet navigation requirements. The

controlling depth is the shallowest depth existing anywhere in a given reach at one point in time, and represents the severest restriction to passage on the given reach. Such shoaling is an indication that more dredging should be done to realize the authorized project benefits if equipment and funds allow.

3. The conclusions drawn from the hypothetical example are not valid, mainly due to an incomplete understanding by EDF of the shoaling process. The amount of shoaling does not depend solely on channel depth. Shoaling is dependent on the sediment load of the waters, velocity, alignment and other factors. Following the hypothetical example, a decrease in maintenance from 12 feet to 10 feet in a channel that shoals to 8 feet will not necessarily bring about a 50 percent decrease in dredging requirements. During the short period that the channel is filling from 12 feet to 10 feet dredging would be greatly reduced. Afterwards, if the waters continue to release approximately the same sediment load as before, dredging requirements could be approximately the same as with the 12-foot channel depth.

4. The suggested comparison table, although attractive in its simplicity, would not provide adequate cost/benefit information. Because much of the traffic does not travel the entire length of the project, a breakdown of vessels by depth for each reach would have to be developed for both commercial and recreational traffic. Further, a dollar value would have to attached to each vessel trip by cargo category and adjusted by miles travelled. The generation of this large amount of information, not currently available, can not be justified, based on the reliability of such data involving gross assumptions (average figures for shipping costs, benefits, and amount of dredging) and recording methods (counting recreational vessels). See also the related portions of responses (1), (2) and (3) above and the justification performed for authorization to present depths in Section 1.03.

5. Turbidity curtains, although practical in open areas with a fairly stable bottom, are not considered practical for general use in the AIWW. To effectively contain silt in such a narrow channel (total width of only about 200 feet) having a silt bottom, the curtain would have to cover the entire channel. Since many dredging contracts require several months to complete, the use of a silt curtain would require blocking of all traffic in the waterway for extended periods of time. An additional major disadvantage of using turbidity curtains in a narrow, shallow channel such as the AIWW arises from the frequent movement of the dredge, which would require a corresponding movement of the turbidity curtain.

6. Because movements of different species take place at different times of the year, avoidance of all spawning cycles and juvenile forms would place further restrictions on the availability of dredges, which even now can not meet all requirements of the project as authorized. See also response (1). The exact extent of every conceivable impact of

the proposed maintenance on larval fish and juvenile forms is not known; nor can the exact extent be reasonably calculated, due to the large number of variables involved. The Draft EIS accurately described the susceptibility of these fish to hypothetical conditions in order to consider all possible impacts. This does not imply that high mortalities or decrease in populations have been documented in areas of dredging operations. In fact, maintenance to the present depth since 1940 has demonstrated no severe impact on the fish mentioned. "Spring tides" are defined by the National Ocean Survey as "tides of increased range occuring semi-monthly as the result of the moon being new or full". These "spring tides" occur throughout the year and cannot be avoided in dredging contracts as extensive as those along the AIWW.

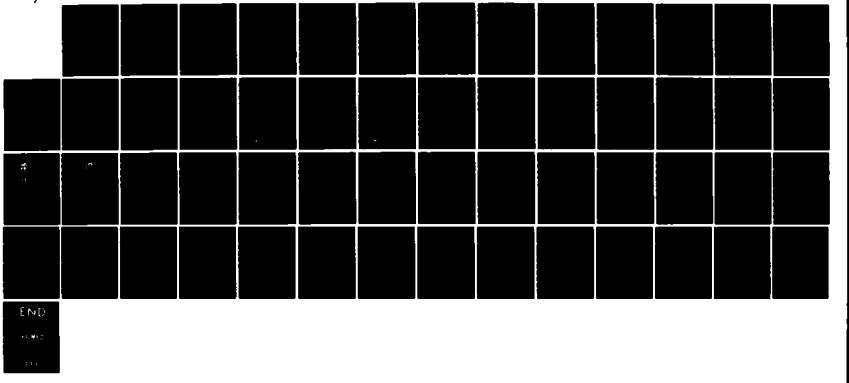
7. The comment that repeated dredging will prevent complete recovery of benthic organisms to the original conditions is valid and was clearly stated in the Draft EIS. The quoted passage from Sherk (1971) states that in his studies diversity was lowered and population, though lower than the surrounding area, was of the same order of magnitude. The significance of the impact on the total benthic community is a function of that proportion of the total benthos disturbed and the severity of the disturbance. Since a large portion of the AIWW was constructed in former uplands or irregularly flooded lands, a return to original conditions in these areas would not benefit benthic organisms. That portion of the AIWW which was constructed in open water or low marshland is a small part of the total South Carolina benthic habitat. The portion which receives regular dredging is smaller still. This is evident from the aerial mosaics of Appendix A and Table 2 of the Draft EIS. That disturbance which does occur due to regular dredging is mitigated by the recovery as described in Sections 4.03.01, 4.03.01.1 and 4.03.01.2. The conclusion that "the overall long-term impact on benthic invertebrates will be insignificant" is, therefore, supported.

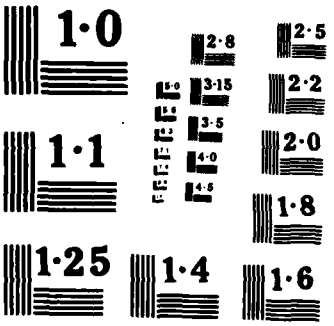
8. See responses (1), (2) and (3) regarding channel depth and shoaling. As stated, current dredging frequencies do not now provide the benefits authorized in the 1937 Rivers and Harbors Committee Document No. 6.

9. A recommended distance above the high water mark and pre-treatment of dredged material prior to disposal in upland or other sites are not discussed in 40 FR 41292, September 5, 1975 or any other applicable regulations. Holding of any polluted material in diked sites may be necessary. In any case, effluent will meet state and Federal water quality standards. Nor are specific prescribed analyses required under this regulation as implied in this comment. The September 5, 1975 regulation provides general guidelines and leaves the choice of methods and the constituents to be analyzed largely up to the discretion of the District Engineer. More specific guidelines are to be published by EPA at a later, unspecified date. Until such specific guidelines are published, the choice of disposal sites and treatment of dredged materials will be handled on a case-by-case basis, as suggested by EPA. In the meantime, the Charleston District has begun a sampling program to update existing information on the chemical constituents of shoal materials for all dredging projects. This information will be useful in the coordination of dredging activities as described in paragraph 1.04.03.

AD-A152 186 MAINTENANCE DREDGING OF ATLANTIC INTRACOASTAL WATERWAY 2/2
SOUTH CAROLINA(U) CORPS OF ENGINEERS CHARLESTON SC
CHARLESTON DISTRICT APR 76

UNCLASSIFIED F/G 13/2 NL




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10. Specific disposal sites now being used and anticipated for the immediate future have been discussed in the EIS and are delineated in the aerial mosaic maps. Sites for long-term use are discussed in Section 1.05. See also response (1) to U. S. Department of Commerce.

11. As future sites are to be chosen by the case-by-case selection process described in Section 1.04.03, description of these areas is not possible.

12. In order to pump material the full 5,000 feet from the channel, the pipeline would have to be perpendicular to the channel. Further, for every yard the dredge moves forward the entire pipeline would have to be moved an equal distance, and dredged material would be discharged along a continuous strip. This represents the extreme case, but points out the problem overlooked by EDF. Unless the pipeline is allowed to trail behind the dredge for extended lengths, insurmountable pipeline mobilization and demobilization problems occur, and more disposal areas would be required.

13. The Corps, in considering both environmental and economic factors, is faced with limited funds such that, at present costs, all the authorized benefits are not provided (see response 2). Increased costs for disposal have not been rejected as implied in this comment. The intent of the Corps to discontinue use of wetlands and to use more expensive upland or ocean disposal methods has been stated in this EIS and 39 FR 26635-26641, "Federal Projects Involving the Disposal of Dredged Material in Navigable Waters", July 22, 1974.

14. In addition to response 13 above, see Section 1.04 and 1.04.1 of the EIS in regard to selection of sites.

15. The EDF appears to have confused the purpose of the disposal operation with a possible side effect. The purpose of the disposal operation is simply to get rid of the dredged material and any benefit accruing to the owner from the disposal of dredged material on his property is a side effect. The Congressional acts authorizing the AIWW required the project sponsor, the State of South Carolina, to provide all disposal areas. The State has met this responsibility by obtaining easements which simply authorize the Corps to deposit dredged material within a specified area for either a specified period of time or until a specified elevation has been achieved. We have no further rights in this private property. We do not plan to examine, as suggested in this comment, the imposition of limitations on the use of private land altered by the dredging operation because we have no authorization for doing so.

17. The geology and wildlife discussions are valuable to persons sufficiently knowledgeable to apply them. The choice of future upland disposal sites, suitability of dredged material for fill or beach improvement, and information related to water tables and salt water

intrusion are a few examples where this information has been or will be applied. Food chains and functional relationships are adequately discussed in Section 2.0.

Environmental Defense Fund, Letter of 3 December 1975

1. The only foreseeable impacts due to other related Federal projects in combination with the AIWW are beneficial.

(a) In areas where the AIWW intersects or coincides with other Federally or privately maintained channels, the combined environmental impacts are less than if two separate channels were to exist.

(b) The Cooper River Rediversion Project will result in a reduced dredging requirement for that portion of the AIWW in or adjacent to Charleston Harbor.

2. The facts presented by EDF, case cited as NRDC vs Calloway, 8 ERC 1273, 1280-81, (2nd Cir. 1975) are not pertinent to the proposed AIWW project.

(a) The material to be dumped in Long Island Sound was highly polluted. Material from the AIWW is not highly polluted. Most of the material is dredged from undeveloped inaccessible areas. The interim EPA guideline limits which were included with the sediment analyses in the Draft EIS are no longer applicable.

(b) The project in Long Island Sound involved an open water disposal site used for other Federal projects and private disposal. A genuine concern was raised that the combined dumping in the same area might result in harmful concentrations of pollutants which might be driven by currents to shellfishing and recreation areas. None of the AIWW disposal sites are used by other Federal or private projects. In the event that highly polluted materials should be discovered, they will be deposited in upland sites and will not be subject to movement.

3. Requirements of the NEPA are satisfied by the EIS as presently drafted in that the environmental effects of disposal in the subject disposal areas are discussed. Since there are no other Federal or private agencies utilizing the AIWW disposal areas, there is no need to discuss their cumulative effect. The facts of the case cited by EDF do not support the earlier comment.

South Carolina Environmental Coalition

1. Aerial mosaics in Appendix A of the Draft EIS (Appendix B of the Final EIS) located all diked disposal sites. These diked sites are now being used and are expected to be used for the immediate future until filled to capacity. The original easements for disposal were obtained by the local sponsor at a time then little concern was expressed by Government agencies or individuals for the now appreciated values of wetlands. As can be seen in the conflicting recommendations

for disposal by various agencies in this EIS, no one method of disposal is devoid of environmental impacts. Further, preferences for disposal methods expressed by cognizant agencies have varied from one project to another and over a period of time as new criteria are applied. A basic issue is land use, and land use decisions require both cooperation and concession. Because of the wide geographical area of the subject project and the long period during which maintenance will be required, the selection process described in Section 1.04.1 is felt to be the best approach for avoiding adverse impacts as they are now anticipated and as they are further appreciated in the future.

2. The argument by hyperbole forming the major part of this comment ignores the prominent statements in the Draft EIS which describe the intent of the Corps to discontinue use of marshlands after the sites now being used are filled to capacity. "Federal Projects Involving the Disposal of Dredged Material in Navigable Waters", 39 FR 26635-26641, July 22, further states the Corps' intention to discourage the use of wetlands and marsh as future disposal sites.

3. We consider the cooperative selection process on a case-by-case basis to be the best method for choosing disposal sites, as discussed in response (1) above. The EIS includes all the impacts anticipated from the use of diked sites in the immediate future, and from any sites which might be chosen once the diked sites are filled to capacity. If the choice of any sites results in significant impacts not anticipated in the Final EIS, a supplement to the Final EIS will be prepared.

4. See revisions to Sections 1.03, 1.05.2 and responses 1-4 to the Environmental Defense Funds' letter of October 28, 1975.

5. See revision to Section 1.01.

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APPENDIX A

Letter of Comment on Draft EIS

APPENDIX A

LETTERS OF COMMENT

	Page No.
Government Agencies	
U. S. Department of Agriculture, Forest Service	A-1
U. S. Department of Agriculture, Soil Conservation	A-1
U. S. Department of the Interior	A-2
U. S. Environmental Protection Agency	A-3
U. S. Department of Commerce	A-4
Federal Power Commission	A-6
U. S. Department of Transportation	A-7
Department of Housing and Urban Development	A-7
Department of Health, Education, and Welfare	A-8
Department of Health, Education, and Welfare, Center for Disease Control	A-8
S. C. State Land Resources Conservation Commission	A-13
S. C. Wildlife and Marine Resources Department	A-13
S. C. Department or Archives and History	A-14
S. C. State Archaeologist	A-15
S. C. Department of Health and Environmental Control Division of Vector Control	A-16
S. C. Department of Health and Environmental Control Programs Development Division	A-17
Environmental Defense Fund	A-17
Environmental Defense Fund	A-21
S. C. Environmental Coalition	A-29

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Southeastern Area, State and Private Forestry
Atlanta, Georgia 30309

November 4, 1975

Colonel Harry S. Wilson, Jr.
Department of the Army
Charleston District, Corps of Engineers
P. O. Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

Here are United States Forest Service, State and Private Forestry comments on the draft Environmental Statement entitled, "Maintenance Dredging of Atlantic Intracoastal Waterway, South Carolina."

A-1

Present disposal of dredged materials in diked marshlands does not significantly impact forest lands and resources of the area. However, any change to upland disposal sites to protect ecologically valuable marshlands could have significant impact. (1)

We commend the Charleston District plan to coordinate, on a case by case basis, all future dredging activities with the Environmental Protection Agency and other interested Federal and State Agencies as specified in section 1.04.02. The South Carolina State Commission of Forestry is the State and Private Forestry Cooperator in South Carolina. Consequently, we recommend close coordination with this State Agency in the selection and use of wooded sites for the disposal of dredged materials. (2)

Thank you for the opportunity to review and comment on this good draft Environmental Impact Statement.

Sincerely,

ROBERT K. DODSON
Area Environmental Coordinator

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
240 Stoneridge Drive, Columbia, South Carolina 29210

September 30, 1975

Colonel Harry S. Wilson, Jr.
District Engineer
Corps of Engineers
P. O. Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

We have reviewed the draft environmental impact statement for the maintenance dredging of the Atlantic Intracoastal Waterway between Little River, S. C. and Port Royal Sound, S. C. and have no comments.

We appreciate the opportunity to review the statement.

Sincerely,

G. E. Huey
State Conservationist

United States Department of the Interior

(1)

(2)

(3)

Page 4a (.11.04.01), South Carolina has recently initiated three significant land and water conservation fund projects located on and adjacent to the Atlantic Intracoastal Waterway. They are, the [illegible]-acre Santee Coastal Preserve, the 2,200-acre Myers Island State Park, and the Waterfront Park located at the Castle Island Bridge in Georgetown, South Carolina. These areas should be mentioned and impacts, if any, should be discussed.

(4)

(5)

The fourth paragraph of the Disposal Areas, page 71, should include a discussion on the necessity of cultural resource surveys in the event any new disposal sites.

(6)

Comments of the State Historic Preservation Officer should appear in the final statement.

(7)

Because of the interagency coordination of all future dredging work in this area, this statement should not serve as a substitute for separate environmental assessments of specific individual actions. It is therefore recommended that environmental statements or supplements be prepared on those actions having significant environmental impacts.

(8)

Sincerely yours,

Stanley A. Horowitz

Deputy Assistant Secretary of the Interior

Colonel Harry D. Wilson, Jr.
District Engineer
Corps of Engineers
Department of the Army
P.O. Box 919
Charleston, South Carolina 29402

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
1421 PEACHTREE ST., N. E.
ATLANTA, GEORGIA 30309

November 18, 1975

Colonel Harry S. Wilson, Jr., USA
Corps of Engineers, Charleston District
P. O. Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

We have reviewed the Draft Environmental Impact Statement for the Operation and Maintenance of the Atlantic Intracoastal Waterway (AIWW) and offer the following comments.

The proposed project could cause significant water quality degradation in nearby waterways if proper precau ons are not taken. Therefore, precautions identified in the Interim inal Guidelines on the discharge of dredged or fill material (Federal Register, Volume 40, Number 173 - September 5, 1975) should be used during the project life. (1)

Also, the overall Statement could be improved by giving additional details, such as a description and location of each shoal to be dredged, including quantities of materials to be dredged, soil types, frequency of dredging, location of disposal site, area of site and biota present on the site. (2) (3) The Statement could be improved further by giving a more complete discussion of the alternatives including methods of disposal by the use of equipment more environmentally oriented. Good marsh remains and every effort must be made to preserve and maintain this marsh at maximum productivity. This can be accomplished to a large extent by the following procedures: (4)

1. Spoiling in existing diked areas where the land has already been elevated above the mean high water level. (5)

2. Spoiling on existing spoil mounds and by diking the area to confine the spoil. (6)

3. Locating spillway outlets so that they discharge to or drain back to the AIWW, thereby preventing siltation of marshlands adjacent to the diked areas.

4. Where spoil sites other than marsh are not available, use alternate methods of disposal such as ocean dumping, beach disposal or find upland sites. (7)

5. Develop environmentally oriented equipment for more efficient transport of material and with more versatile discharge so that materials could be bottom dumped in deep water or pumped to upland sites or beach dune areas or beaches. (8)

In regard to Item 5 above, we believe another chapter could evaluate the acquisition of improved environmentally oriented equipment capable of efficiently transporting and discharging spoil on upland sites, on beaches or in the ocean. We believe that the basic equipment for these operations is already available and that it could be obtained if properly specified. (9)

In view of the foregoing, we have rated the project LO- (Lack of Objection) and 2 (Insufficient Information) to the Impact Statement.

Please furnish us with five (5) copies of the Final Statement and let us know if we may be of further service.

Sincerely,

David R. Hopkins
Chief, EIS Branch

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230

November 14, 1975

Colonel Harry S. Wilson,Jr.
Charleston District, Corps of Engineers
Department of the Army
Post Office Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

This is in reference to your draft environmental impact statement entitled "Maintenance Dredging of Atlantic Intracoastal Waterway, South Carolina". In order to expedite transmittal of the enclosed comments from the National Oceanic and Atmospheric Administration, we are sending them to you as they were received in this office.

Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We would appreciate receiving eight copies of the final statement.

Sincerely,

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

Enclosure: Memo from: Mr. William H. Stevenson
National Marine Fisheries Service

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Duval Building
9450 Gandy Boulevard
St. Petersburg, FL 33702

NOV 4 1975

October 29, 1975 FSE21/RPC

TO: Director
Ofc. of Ecology & Environmental Conservation, EE
NOV 04 1975

THRU: Associate Director for
Resource Management, F3

FROM: William H. Stevenson
Regional Director

SUBJECT: Review of DEIS #7509.48 - Maintenance Dredging of Atlantic Intracoastal Waterway, SC (CE)

The subject DEIS that accompanied your memorandum of September 25, 1975, has been received by the National Marine Fisheries Service for review and comment.

We have reviewed the subject DEIS and offer the following comments as they relate to project effects to marine, estuarine and anadromous fishery resources which come under the purview of the NMFS.

GENERAL COMMENTS:

Due to the lack of specific information on the dredging plan in the DEIS it is difficult to review the statement with regard to project effects to aquatic resources. It is apparent that the Corps is unsure of the methods of dredged material disposal which will be employed in future years. Since disposal practices present a great potential for environmental damage, the uncertainty associated with the disposal methods to be employed, precludes an adequate assessment of potential environmental effects. The DEIS additionally makes numerous statements regarding the environmental significance of various dredging practices without presenting supporting data.

SPECIFIC COMMENTS:

2.0 Existing Environmental Setting
Page 46, paragraph 2.09.04.2.2

Reference is made to enrichment and subsequent increased production of Spartina alterniflora as a result of sewage pollution. This demonstrates an extremely valuable function of S. alterniflora and wetlands in general, in that they function as natural tertiary sewage treatment systems. This role should be further discussed as it relates to the importance of maintaining these natural systems. (2)

Page 49, paragraph 2.09.04.3

In discussing the role of tidal flats to the estuarine system, the DEIS has failed to discuss the role of these flats and associated benthos in cycling energy from plants to higher animals. Without these communities an essential link in the conversion of plant matter to a form useable by higher aquatic organisms will be lost. (3)

4.0 The Probable Impact of the Proposed Action on the Environment
4.03 Biological Resources
Page 63, paragraph 4.03.01

After dredging, even though population levels of benthic organisms may approach predredging levels, as stated in this paragraph, a reduction in species diversity could result in a community less stable than previously existed. (a) Periods of adverse environmental stresses could invariably prove more damaging to the less stable community especially if the major constituents of the benthos are effected. (b) It should also be noted that settlement and hence repopulation of benthos is also related to substrate, depth, light intensity, biological attractants, etc. The DEIS does not make reference to these factors as they effect the recolonization of dredged areas. (c) Furthermore, no evidence is presented which demonstrates that benthic communities will not be adversely effected by dredging practices, especially new work, e.g. widening and/or deepening of existing channels. (d) (4)

Page 65, paragraph 4.03.03.1

Even though certain fish species may benefit by increased availability of food due to dredging practices, it should be stressed that these benefits will be of a very temporary nature and in the long range may prove deleterious by depleting existing food sources. (5)

Page 67, paragraph 4.03.04.2

The tertiary sewage treatment potential of marshes should also be stressed. The value of this function has been quantified by Gosselink, Odum and Pope, 1974.[1] (6)

5.0 Any Probable Adverse Environmental Effects Which Cannot be Avoided
Page 71, paragraph 5.01

Without specific details of unfavorable impacts mentioned in this paragraph we are unable to determine how they relate to the authority and scope of the proposed project. (7)

6.0 Alternatives to the Proposed Action
Page 72, paragraph 6.02.01

Relocation of the disposal areas - This section should also discuss the possible removal of material from these high land disposal areas for uses in agriculture, construction, industry, etc. (8)

Page 72, paragraph 6.02.02

Tidal flats and shallow water bodies are essential to the estuary since they support organisms which convert plant matter to a form useable by high aquatic organisms. Additionally, these areas are necessary for the production of shellfish. Since shallow open bodies of water are few in South Carolina, the alternative of marsh construction, resulting in the loss of open-water habitat, would appear unfeasible and destructive to the estuarine system. (9)

7.0 The Relationship Between Local Short-term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

Since shallow open bodies of water and associated biota are essential to the estuarine system of South Carolina, the construction of marsh in these areas is biologically impractical, therefore, any destruction of marsh by filling does in fact represent an irretrievable loss of that resource. Additionally, it has not been demonstrated that artificial marshes are as productive, contain the same tidal channels necessary for fish and shellfish production, or contain the same biota as found in natural marsh systems. (9)

Page 74, paragraph 7.03

In reference to this paragraph, we doubt that continued maintenance dredging could increase long-term productivity even if it resulted in a net increase in marsh area.

8.0 Any Irreversible and Irretrievable Commitments of Resources Which Would be Involved in the Proposed Action

In our opinion, since the creation of marsh would not prove a feasible alternative to spoil disposal in South Carolina, we doubt that this method would offset prior commitments of marsh resources. (9)

It is requested that one copy of the Final EIS be sent our Area Supervisor, Environmental Assessment Division, NMFS, P.O. Box 570, Beaufort, NC 28516.

cc:
F34, NMFS, Washington, D.C. (3)
FSE211, Beaufort, NC

1/ Gosselink, J. G., E.P. Odum, and P.M. Pope. 1974. The Value of the Tidal Marsh. Center for Wetland Resources, Louisiana State University, Baton Rouge, No. LSU-SG-74-03.

FEDERAL POWER COMMISSION
REGIONAL OFFICE
730 Peachtree Building
Atlanta, Georgia 30308
October 10, 1975

District Engineer
Corps of Engineers
Department of the Army
Post Office Box 919
Charleston, S. C. 29402

Dear Sir:

We have reviewed the draft environmental impact statement for the maintenance dredging of the Atlantic Intracoastal Waterway between Little River, South Carolina, and Port Royal Sound, South Carolina, which was received with your letter of September 15, 1975, your file SANGR.

The Commission's responsibilities relate to the construction and operation of natural gas pipelines under the Natural Gas Act, and the reliability and adequacy of electric service and the development of hydroelectric power under the Federal Power Act.

In reviewing this plan we noted nothing that would interfere with any licensed hydroelectric project under the Commission's jurisdiction. However, any natural gas pipelines or electrical transmission lines in a construction area should be protected.

We appreciate the opportunity to comment on this proposed project.

Very truly yours,

C. L. Fishburne

C. L. Fishburne
Regional Engineer

2cc: Div. Engr.
Atlanta, Ga.

Reference is made to enrichment and subsequent increased production of Spartina alterniflora as a result of sewage pollution. This demonstrates an extremely valuable function of S. alterniflora and wetlands in general, in that they function as natural tertiary sewage treatment systems. This role should be further discussed as it relates to the importance of maintaining these natural systems. (2)

Page 49, paragraph 2.09.04.3

In discussing the role of tidal flats to the estuarine system, the DEIS has failed to discuss the role of these flats and associated benthos in cycling energy from plants to higher animals. Without these communities an essential link in the conversion of plant matter to a form useable by higher aquatic organisms will be lost. (3)

4.0 The Probable Impact of the Proposed Action on the Environment
4.03 Biological Resources
Page 63, paragraph 4.03.01

After dredging, even though population levels of benthic organisms may approach predredging levels, as stated in this paragraph, a reduction in species diversity could result in a community less stable than previously existed (a) Periods of adverse environmental stresses could invariably prove more damaging to the less stable community especially if the major constituents of the benthos are effected (b) It should also be noted that settlement and hence repopulation of benthos is also related to substrate, depth, light intensity, biological attractants, etc. The DEIS does not make reference to these factors as they effect the recolonization of dredged areas (c) Furthermore, no evidence is presented which demonstrates that benthic communities will not be adversely effected by dredging practices, especially new work, e.g. widening and/or deepening of existing channels. (d) (4)

Page 65, paragraph 4.03.03.1

Even though certain fish species may benefit by increased availability of food due to dredging practices, it should be stressed that these benefits will be of a very temporary nature and in the long range may prove deleterious by depleting existing food sources. (5)

Page 67, paragraph 4.03.04.2

The tertiary sewage treatment potential of marshes should also be stressed. The value of this function has been quantified by Gosselink, Odum and Pope, 1974.1/ (6)

5.0 Any Probable Adverse Environmental Effects Which Cannot be Avoided
Page 71, paragraph 5.01

Without specific details of unfavorable impacts mentioned in this paragraph we are unable to determine how they relate to the authority and scope of the proposed project. (7)

6.0 Alternatives to the Proposed Action
Page 72, paragraph 6.02.01

Relocation of the disposal areas - This section should also discuss the possible removal of material from these high land disposal areas for uses in agriculture, construction, industry, etc. (8)

Page 72, paragraph 6.02.02

Tidal flats and shallow water bodies are essential to the estuary since they support organisms which convert plant matter to a form useable by high aquatic organisms. Additionally, these areas are necessary for the production of shellfish. Since shallow open bodies of water are few in South Carolina, the alternative of marsh construction, resulting in the loss of open-water habitat, would appear unfeasible and destructive to the estuarine system. (9)

7.0 The Relationship Between Local Short-term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

Since shallow open bodies of water and associated biota are essential to the estuarine system of South Carolina, the construction of marsh in these areas is biologically impractical, therefore, any destruction of marsh by filling does in fact represent an irretrievable loss of that resource. Additionally, it has not been demonstrated that artificial marshes are as productive, contain the same tidal channels necessary for fish and shellfish production, or contain the same biota as found in natural marsh systems. (9)

Page 74, paragraph 7.03

In reference to this paragraph, we doubt that continued maintenance dredging could increase long-term productivity even if it resulted in a net increase in marsh area.

8.0 Any Irreversible and Irretrievable Commitments of Resources Which Would be Involved in the Proposed Action

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
2001 Assembly Street, Suite 203
Columbia, South Carolina 29201

26 SEP 1975

September 25, 1975

Department of The Army
Charleston District, Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Sir:

Reference is made to your letter dated September 15, 1975 transmitting, for our review and comment, two copies of the draft environmental *impact statement for maintenance dredging of the Atlantic Intra-*coastal Waterway between Little River, South Carolina and Port Royal Sound, South Carolina.

We have reviewed the statement, and no conflicts within FHWA mission areas were noted.

Sincerely yours,

for: W. N. Rice, Jr.
W. N. Dulin
Division Administrator

A-7

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
COLUMBIA AREA OFFICE
1801 MAIN STREET, JEFFERSON SQUARE
COLUMBIA, SOUTH CAROLINA 29201

REGION IV
Peachtree-Seventh Building
50 Seventh Street, N.E.
Atlanta, Georgia 30323

November 11, 1975

IN REPLY REFER TO:
4.3SS, Room 602

Colonel Harry S. Wilson, Jr.
District Engineer, Department of the Army
Charleston District
Corps of Engineers
P. O. Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

Subject: Draft Environmental Impact Statements
1. Maintenance Dredging of Charleston Harbor in Charleston and Berkeley Counties, S. C.
2. Maintenance Dredging of the Atlantic Intracoastal waterway, between Little River and Port Royal Sound, S.C.

The subject documents have been reviewed by our Area Office Staff, and it is our determination that there will be no effect on any existing or proposed HUD activities. We appreciate the opportunity to have reviewed these documents, and look forward to receipt of the final EIS's as they become available.

Sincerely,

For Franklin H. Corley
Area Director

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
REGION IV
50 7TH STREET, N.E.
ATLANTA, GEORGIA 30323
September 19, 1975

OFFICE OF THE
REGIONAL DIRECTOR

HEW 578-9-75

Mr. Harry S. Wilson, Jr.
District Engineer
Department of the Army
Charleston District Corps of Engineers
P.O. Box 919
Charleston, S.C. 29402

Subject: Maintenance Dredging of Atlantic
Intracoastal Waterway, S.C.

Dear Mr. Wilson:

We have reviewed the subject draft Environmental Impact Statement. Based upon the data contained in the draft, it is our opinion that the proposed action will have only a minor impact upon the human environment within the scope of this Department's review. The impact statements have been adequately addressed for our comments.

Sincerely yours,

Philip P. Sayre
Regional Environmental Officer
DHEW - Region IV

A-8

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL

December 1, 1975

BUREAU OF LABORATORIES
VECTOR BORNE DISEASES DIVISION
POST OFFICE BOX 2087
FORT COLLINS, COLORADO 80522

District Engineer
U.S. Army Engineer District
Post Office Box 919
Charleston, South Carolina 29402

Dear Sir:

We have reviewed the draft environmental statement on Maintenance Dredging of Atlantic Intracoastal Waterway, South Carolina, and we are submitting our comments in regard to vector-borne disease impacts associated with this project.

Water Resources Branch of Vector-Borne Diseases Division represents the Public Health Service in all matters of vector-borne disease as related to water resource developments, including navigation projects. We are concerned with diseases transmitted to man and animals by insects and other arthropods, with mosquitoes being particularly important in their association with water resources. Almost of equal significance is the serious discomfort caused by these biting pests. We are interested in the control of mosquitoes produced by breeding habitats occurring in deposits of dredged spoil material. In an area so favorable to mosquito production, such as coastal South Carolina, additional mosquito-producing habitats should not be created.

Mosquito problems associated with spoil deposits have been recognized since the early 1940's. Two articles from "Mosquito News" are attached, and they show some of the original thought given to the problem. Where the spoil had stabilized, the use of a harrow to break up the spoil crust showed good results in preventing mosquito production. The State of Virginia had severe similar problems and used granular insecticide formulations as well as harrow, disc, and drag towed by special terrain vehicles. Spoil-mosquito problems in North Carolina occur in deposits with a high silt content. Silt deposits tend to undergo a large amount of cracking, whereas sandy deposits do not. Information from South Carolina indicates that the spoils there in general are the type that undergo much cracking and produce large numbers of mosquitoes.

We note that an "increase in the local mosquito population" is mentioned as an environmental impact and as an adverse environmental effect. We heartily concur with these opinions. However, your statement in paragraph 4.03.10 concerning mosquitoes associated with spoils is incomplete. Diking

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
2001 Assembly Street, Suite 203
Columbia, South Carolina 29201

26 SEP 1975

September 25, 1975

Department of The Army
Charleston District, Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Sir:

Reference is made to your letter dated September 15, 1975 transmitting, for our review and comment, two copies of the draft environmental impact statement for maintenance dredging of the Atlantic Intracoastal Waterway between Little River, South Carolina and Port Royal Sound, South Carolina.

We have reviewed the statement, and no conflicts within FHWA mission areas were noted.

Sincerely yours,

for: W. N. Dulin
W. N. Dulin
Division Administrator

A-7

REGION IV
Peachtree-Seventh Building
50 Seventh Street, N.E.
Atlanta, Georgia 30323

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
COLUMBIA AREA OFFICE
1801 MAIN STREET, JEFFERSON SQUARE
COLUMBIA, SOUTH CAROLINA 29201

November 11, 1975

IN REPLY REFER TO:
4.3SS, Room 602

Colonel Harry S. Wilson, Jr.
District Engineer, Department of the Army
Charleston District
Corps of Engineers
P. O. Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

Subject: Draft Environmental Impact Statements
1. Maintenance Dredging of Charleston Harbor in Charleston and Berkeley Counties, S. C.
2. Maintenance Dredging of the Atlantic Intracoastal waterway, between Little River and Port Royal Sound, S.C.

The subject documents have been reviewed by our Area Office Staff, and it is our determination that there will be no effect on any existing or proposed HUD activities. We appreciate the opportunity to have reviewed these documents, and look forward to receipt of the final EIS's as they become available.

Sincerely,

For Franklin H. Corley
Franklin H. Corley
Area Director

A spoil deposit in itself is not responsible for Aedes sollicitans activity; the nature of the spoil material, as discussed in the preceding paragraph, probably is the major factor. Of course, the rainfall patterns that contribute to the intermittent inundation of the spoils areas in South Carolina are another important aspect. (1)

Mosquito control should include environmental manipulation, such as the use of marsh water exchange, or the potential use of riverine utility craft being studied by the Corps of Engineers Waterways Experiment Station at Vicksburg, Mississippi. (2)

Although mosquito control measures are not funded by Acts of Congress authorizing the Atlantic Intracoastal Waterway, as written in the environmental statement, it is my impression that your statement, "mosquito control operations at disposal areas are a non-federal responsibility" could be locally contested. Perhaps it should be modified to clarify the matter. I briefly discussed this with Mr. Victor Veysey, Assistant Secretary for Civil Works, during his visit to Fort Collins last year. He did not disagree with my contentions. The responsibility for these problems thus falls upon the state and local mosquito control agencies. The cost of controlling mosquitoes associated with spoils is a costly burden upon the county. There certainly seems to be ample legal precedence (Wilmington and North Bonneville) whereby the Corps of Engineers has financed solutions to problems they have created. (3)

Besides Aedes sollicitans, other vector mosquitoes are likely to be associated with spoils. Aedes taeniorhynchus and Psorophora columbiae (confinnis) should be mentioned. (4)

In cooperation with Dr. Bruce Ezell of The Citadel, we plan to test blood sera from resident bird and mammal population to determine if arboviruses have been active recently in the Charleston area. The specimens will be collected in sites situated in and adjacent to spoil deposits, and other locations as well. If the studies are positive, it would be important to insure the control of mosquito production in spoil deposits.

We will appreciate being placed on your mailing list to receive notices of environmental actions related to water resource developments. If we

can further clarify any point or furnish any other information on vector-borne disease control, please let us know.

Sincerely yours,

Richard C. Hayes, Ph.D., M.P.H.
Chief, Water Resources Branch

Enclosures

cc:
Mr. L. A. Williams, Jr.
Dr. W. Bruce Ezell
Mr. Clyde P. Fehn
Mr. Rowland E. Dorer
Mr. Don F. Ashton
Dr. John A. Mulrennan
Dr. Sam G. Breeland
Dr. James V. Smith
Dr. Richard C. Axtell
Dr. Robert M. Altman

A-9

SOME MOSQUITO CONTROL OPERATIONS IN MONMOUTH COUNTY, NEW JERSEY

By HARRY G. VANNOTE, Superintendent
Monmouth County Mosquito Extermination Commission



Fig. 1. A 75 acre hydraulic fill on an open salt marsh near Port-au-peck Spot, pumped from the Shrewsbury River which bounds the marsh on the north; depth of fill 3 to 5 feet.

The fill was made in 1936. In the spring of 1937 shrinkage of the mud upon drying, opened cracks 2 to 4 inches wide extending to a depth of 12 to 14 inches. Heavy rainfall filled these cracks with water, and [illegible] the most serious mosquito breeding areas ever encountered in all the years of mosquito control in Monmouth County. A heavy [illegible] mosquitoes in great [illegible]

It [illegible] to eliminate this breeding area by filling the cracks would have been nearly impossible.

The situation was serious, and instead of [illegible] ing checked or [illegible] the 75 acres of [illegible] cracks with a thin, narrow [illegible] were [illegible] crosswise in the fall of 1937, finishing up with a scraper to complete the filling in of the cracks and leveling off the fill, which transformed an [illegible] mosquito breeding area into a useful tract of land.

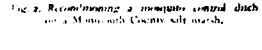


Fig. 2. *Reconstructing a mosquito control ditch on a Monmouth County salt marsh.*

...ATIONS
...ERSEY

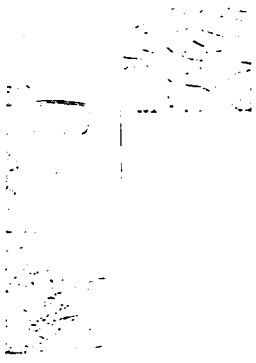


Fig. 3. One of the mec[illegible]

a mosquito control ditch
a County salt marsh.



Fig. 3. One of the mechanized power-spraying trucks operated by the Monmouth County Commission.

[illegible] Aedes sollicitans habitats; the nature of the spoil material, as discussed in the pre-[illegible] marginum, probably is the major factor. Of course, the rainfall patterns that correlate to the intermittent inundation of the spoil areas is of the paramount important aspect. (1)

Natural control would include environmental manipulation, such as the use of water level, or the potential use of riverine utility [illegible] studied by the Corps of Engineers Waterways Experiment [illegible] at Vicksburg, Mississippi. (2)

Although mosquito control measures are not funded by Acts of Congress authorizing the Atlantic Intracoastal Waterway, as written in the environmental statement, it is my impression that your statement, "mosquito control operations at disposal areas are a non-federal responsibility" could be legally misconstrued. Perhaps it should be [illegible] clarify the matter. I briefly discussed this with Mr. Victor Yannacy, Assistant Secretary for Civil Works, during his visit to Fort Pillins last year. He did not disagree with my contentions. The responsibility for these problems would fall upon the state and local mosquito control agencies. The cost of controlling mosquitoes associated with spoil is presently borne upon the county. There certainly seems to be ample legal precedence [illegible]braska and North Bonneville whereby the Corps of Engineers may finance solutions to problems they have created. (3)

Besides Aedes sollicitans, other vector mosquitoes are likely to be associated with spoils. Aedes taeniorhynchus and Psorophora columbiae (confinnis) should be mentioned. (4)

In cooperation with Dr. Grace Lewis of the Patuxent, we plan to test [illegible] sera from resident bird and mammal populations to determine if [illegible] viruses have been active recently in the Charleston area. The specimens will be collected in sites situated in and adjacent to [illegible] disposal sites, and other coastal habitats as well. If the stilles are [illegible] active, it would be my hope to analyze the control of mosquito [illegible] in spoil disposal sites.

We will appreciate your placing us on your mailing list to receive notices of environmental actions involving Federal water resource developments. If we

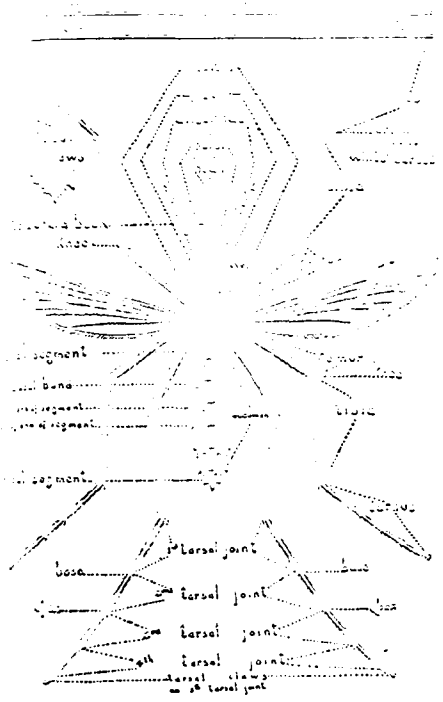
can further clarify any point or furnish any other information on vector-borne disease control, please let us know.

Sincerely yours,

Richard O. Hayes, Ph.D., M.P.H.
Chief, Water Resources Branch

Enclosures

cc:
Mr. L. A. Williams, Jr.
Dr. W. Bruce Ezell
Mr. Clyde P. Fehn
Mr. Rowland E. Dorer
Mr. Don F. Ashton
Dr. John A. Mulrennan
Dr. Sam G. Breeland
Dr. James V. Smith
Dr. Richard J. Axtell
Dr. Robert M. Altman



...ed war has put the finger on the familiar mosquito ...inder the subdivision, but in combined efforts of the ...the Navy, the Public Health Service and the City of ...it will mark its 40th anniversary and in that cluster. ...ly trained in the Public Health Service we ex... ...congratulations on a job well ...but our experience in Keyport leads us to believe ...all-out offensive is needed to bring fully satis... ...ry results. It is our hope that another year may ...mosquito channels produced under attack.

...Submitted By [illegible]
...[illegible]
...[illegible]

William M. Thon
Engineering Inspector
Middlesex County Mosquito
Extermination Commission
Metuchen, New Jersey

...r. J. B. Joffe and Dr. Victor A. Tiedjens of Rutgers ...sity who recently made an inspection of the hydraulic ...t South Amboy, made the following recommendations as ... best means of eliminating the surface cracks on hy... ...ls fills composed mostly of clay and river silt.

First, the surface should be broken up into large lumps by means of a bruiser plow. This should be done in the fall, preferrably after the first frost when the soil will be firm enough to work on. By this means, air will penetrate the soil to a greater depth, thereby hastening the drying out process. At the same time, under the action of frost, the sodium chloride in the soil will be drawn to the surface of the lumps where it will later be washed to the furrows, to be washed away by melting snow and the spring rains. If conditions permit, drainage ditches should be installed in such a manner as to intersect the furrows, in order to remove the surface water as quickly as possible.

After the spring rains have ceased, the ground should be thoroughly harrowed with a disc harrow, after which no further trouble should be experienced with surface cracks. However, if clay is the precominating ingredient, it may be necessary to repeat the process during the next season.

If it is desirable to prevent the growth of Brown mites (Fox Tail), about eight tons of Gypsum per acre should be added to the soil after which Red Top or other suitable grass, preferrably one with creeping stems may be planted.

According to Dr. Joffe, the method outlined above has been used with considerable success in Holland, but is untried in this country as far as he knows.

[illegible]

[illegible]
Assistant Entomologist
[illegible]
Experiment Station.

In the past few years five species have been [illegible]

[illegible] New Jersey [illegible]

The discovery [illegible]

[illegible] Doepfert was [illegible]

[illegible] John Fiveash [illegible]

During the [illegible]

It is interesting [illegible]

A-12

State of South Carolina

Office of the Governor

JAMES B. EDWARDS
GOVERNOR

DIVISION OF ADMINISTRATION
Edgar A. Brown Building
Columbia, South Carolina 29201

November 18, 1975

Colonel Harry S. Wilson, Jr.
District Engineer, Charleston District
Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

The State Clearinghouse has completed its review of the draft environmental impact statement for the maintenance dredging of the Atlantic Intracoastal Waterway between Little River, S. C. and Port Royal Sound, S. C. Enclosed for your information in the preparation of the final statement are comments from the Wildlife and Marine Resources Department, the State Land Resources Conservation Commission, the State Archeologist, and the Department of Archives and History.

Please note Dr. Stephenson's comment in regards to archeological clearance for this project.

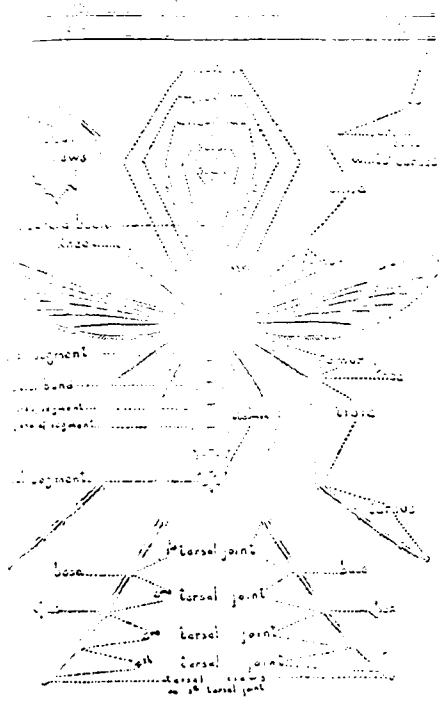
If I can be of any further assistance, please let me know.

Sincerely,

Elmer C. Whitten Jr.
State Clearinghouse

Encl (4)

"Safety Belts — Save Lives and Reduce Injuries"



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...ed, that has put the finishing touch on the fumigation campaign that Public Health officials and the City of Hoboken have waged against mosquitoes in that section.

...ed in the Passaic County Mosquito Extermination Commission's ...

...but experiments on marshes placed it to believe a "kill-out" effective to prevent fully satisfactory results. It is our hope that another year may be accomplished whereby breeding under attack.

...William M. Thom
Engineering Inspector
Mosquito Extermination Commission
Hoboken, New Jersey

...r. J. S. Joffe and Dr. Victor A. Piedjens of Rutgers ...ology have recently made an inspection of the hydraulic ...t South Amboy, made the following recommendations as ... best means of eliminating the surface cracks on hy... fills composed mostly of clay and river silt.

South Carolina
Project Notification & Review System

PROJECT NOTIFICATION REFERRAL

TO: [illegible]

RECEIVED
OCT 14 1975
DIVISION OF ADMINISTRATION

STATE APPLICATION IDENTIFIER

Clearinghouse Use Only
CONTROL NUMBER
DIST. NO. FY
11 [illegible] 6

SUSPENSE DATE
10/13

The attached project notification is being referred to your agency in accordance with Office of Management and Budget Circular A-95. This System coordinates the review of proposed Federal or federally assisted development programs and projects. Please provide comments below, relating the proposed project to the plans, policies, and programs of your agency. All comments will be reviewed and compiled by the State Clearinghouse. Any questions may be directed to this office by phone at 758-2940. Please return this form prior to the above suspense date to:

State Clearinghouse
Division of Administration
1205 Pendleton Street
Columbia, South Carolina 29201

Signature: Elmer E. Whitten Jr.
Name: Elmer E. Whitten, Jr.
Title:

RESULTS OF AGENCY REVIEW

- ☐ PROJECT CONSISTENT WITH AGENCY PLANS AND POLICIES
- ☐ AGENCY REQUESTS CONFERENCE TO DISCUSS COMMENTS
- ☑ AGENCY COMMENTS ON CONTEMPLATED APPLICATION AS FOLLOWS

The Commission recommends that the proposed method of disposing of spoil by pumping spoil onto upland soils not be adopted. The upland areas comprise the principal areas suited to farming operations. This would deny the landowners access to their principal crop producing soils. (1)

(use separate continuation sheets if necessary)

FOR THE REVIEWING AGENCY:
SIGNATURE: Ralph Ed Mudd
TITLE: Asst Chief
DATE: Oct 13, 1975
PHONE: 758-7197

OMB Form [illegible]

South Carolina
Project Notification & Review System

PROJECT NOTIFICATION REFERRAL

TO: S. C. Wildlife and Marine Resources
P. O. Box 167
Columbia, SC 29202

RECEIVED
OCT 2 2 1975
RESOURCES DEPARTMENT

STATE APPLICATION IDENTIFIER

Clearinghouse Use Only
CONTROL NUMBER
DIST. NO. FY
11 [illegible] 6

SUSPENSE DATE
10/13

The attached project notification is being referred to your agency in accordance with Office of Management and Budget Circular A-95. This System coordinates the review of proposed Federal or federally assisted development programs and projects. Please provide comments below, relating the proposed project to the plans, policies, and programs of your agency. All comments will be reviewed and compiled by the State Clearinghouse. Any questions may be directed to this office by phone at 758-2940. Please return this form prior to the above suspense date to:

State Clearinghouse
Division of Administration
1205 Pendleton Street
Columbia, South Carolina 29201

Signature: Elmer E. Whitten Jr.
Name: Elmer E. Whitten, Jr.
Title:

RESULTS OF AGENCY REVIEW

- ☐ PROJECT CONSISTENT WITH AGENCY PLANS AND POLICIES
- ☐ AGENCY REQUESTS CONFERENCE TO DISCUSS COMMENTS
- ☒ AGENCY COMMENTS ON CONTEMPLATED APPLICATION AS FOLLOWS

RECEIVED OCT 10 1975 DIVISION OF ADMINISTRATION

We have reviewed the Draft Environmental Statement by the Corps of Engineers for maintenance dredging of the Atlantic Intracoastal Waterway in South Carolina and offer the following remarks.

The draft statement appears to be fairly comprehensive regarding discussion of the major environmental aspects and alternatives of the proposed project.

The following are specific comments on various sections of the draft environmental statement.

1. On page 32 (2.09.02.2) American beach grass (Ammophia breviligulata) is listed as a typical dune plant. Although this plant is prevalent in North Carolina sand dunes, the natural occurrence of beach grass

(use separate continuation sheets if necessary)

FOR THE REVIEWING AGENCY:
SIGNATURE: [signature]
TITLE: Executive Director
DATE: October 6, 1975
PHONE: [illegible]

OMB Form 7 (4/15/74)

apparently terminates in the vicinity of the N. C. - S. C. border and therefore, should not be classified as a typical South Carolina dune species. However, K. E. Graeta, (1973, Seacoast Plants of the Carolinas) reports that the Soil Conservation Service has successfully planted beach grass in three S. C. locations, Pawleys Island and beach sites near Georgetown and Charleston. (1)

2. On page 46 (2.09.04.2.1) Smalley (1959) has been incorrectly cited. The link between fish and marsh is evident according to Teal (1962) and not Smalley, for Smalley described the relationship between the growth of Spartina grass and the herbivorous insect populations in the marsh. (2)

3. The discussion of the high marsh vegetation (p. 47, 2.09.04.2.7) should mention the occurrence of intermediate and stunted forms of smooth cordgrass above the mhw mark. (3)

4. Isopods are common to salt marshes and should be included in the list of tidal marsh fauna presented in Section 2.09.04.2.8 (pg. 48). (4)

5. The speckled trout does not necessarily spend its entire life in estuaries, contrary to the statement on page 66 (4.03.04.2). It is found all along the coast in nearshore ocean waters as well as within estuaries. (5)

We appreciate having been asked to comment on this draft environmental statement and look forward to receiving a copy of the final statement, when available.

JATjr:cs

South Carolina
Project Notification & Review System

PROJECT NOTIFICATION REFERRAL

STATE APPLICATION IDENTIFIER
Clearinghouse Use Only
CONTROL NUMBER
DIST. NO. FY
13 2005 6
SUSPENSE DATE
10/13

TO: Dr. Charles Lee
Dept of Archives & History
P. O. Box 11669
Columbia, SC 29211

RECEIVED
SEP 22 1975
S. C. DEPARTMENT OF ARCHIVES & HISTORY

The attached project notification is being referred to your agency in accordance with Office of Management and Budget Circular A-95. This System coordinates the review of proposed Federal or federally assisted development programs and projects. Please provide comments below, relating the proposed project to the plans, policies, and programs of your agency. All comments will be reviewed and compiled by the State Clearinghouse. Any questions may be directed to this office by phone at 758-2946. Please return this form prior to the above suspense date to:

State Clearinghouse
Division of Administration
1205 Pendleton Street
Columbia, South Carolina 29201

Signature: Elmer C. Whitten Jr.
Name: Elmer C. Whitten, Jr.

RESULTS OF AGENCY REVIEW

☐ PROJECT CONSISTENT WITH AGENCY PLANS AND POLICIES

☐ AGENCY REQUESTS CONFERENCE TO DISCUSS COMMENTS

☒ AGENCY COMMENTS ON CONTEMPLATED APPLICATION AS FOLLOWS:

No National Register properties appear to be affected by this project. We know of no other historical properties, including those eligible for the National Register, that need to be taken into account.

When additional disposal areas are chosen in the future, we hope that the Army Corps will consult with this office, and the pertinent Regional Councils of Governments, about historical and archeological properties that could be affected (by spoil deposition). For archeological information please contact the University of South Carolina Institute of Archeology and Anthropology.

RECEIVED
OCT 17 1975
DIVISION OF ADMINISTRATION

(Use separate continuation sheets if necessary)

FOR THE REVIEWING AGENCY:
SIGNATURE: William H. Readham DATE: 10/15/75
TITLE: Coordinator, Historic Preservation Division PHONE: 758-5816

DOA Form 7 (4/15/74)

South Carolina
Project Notification & Review System

PROJECT NOTIFICATION REFERRAL

TO: St. Land Resources Conserv.
P. O. Bx 11280
Columbia, SC 29211

RECEIVED
OCT 14 1975
DIVISION OF ADMINISTRATION

STATE APPLICATION IDENTIFIER

Clearinghouse Use Only
CONTROL NUMBER
DIST. NO. FY
11 2005 5

SUSPENSE DATE
10/15

The attached project notification is being referred to your agency in accordance with Office of Management and Budget Circular A-95. This System coordinates the review of proposed Federal or federally assisted development programs and projects. Please provide comments below, relating the proposed project to the plans, policies, and programs of your agency. All comments will be reviewed and compiled by the State Clearinghouse. Any questions may be directed to this office by phone at 758-2946. Please return this form prior to the above suspense date to:

State Clearinghouse
Division of Administration
1205 Pendleton Street
Columbia, South Carolina 29201

Signature: Elmer E. Whitten Jr.
Name, Number: Whitten, Jr.

RESULTS OF AGENCY REVIEW

- ☐ PROJECT CONSISTENT WITH AGENCY PLANS AND POLICIES
- ☐ AGENCY REQUESTS CONFERENCE TO DISCUSS COMMENTS
- ☑ AGENCY COMMENTS ON CONTEMPLATED APPLICATION AS FOLLOWS:

The Commission recommends that the proposed method of disposing of spoil by pumping spoil onto upland soils not be adopted. The upland areas comprise the principal areas suited to farming operations. This would deny the landowners access to their principal crop producing soils. (1)

(Use separate continuation sheets if necessary)

FOR THE REVIEWING AGENCY:
SIGNATURE: Roger Ed Rudd DATE: Oct 13 1975
TITLE: Asst Chief PHONE: 758-7197

DOA Form 7 (4/15/74)

South Carolina
Project Notification & Review System

Brandon

PROJECT NOTIFICATION REFERRAL

TO: S. C. Wildlife and Marine Resources
P. O. Box 167
Columbia, SC 29202

RECEIVED
OCT 22 1975
S. C. WILDLIFE AND MARINE RESOURCES DEPARTMENT

cc: CZMC

STATE APPLICATION IDENTIFIER

Clearinghouse Use Only
CONTROL NUMBER
DIST. NO. FY
11 2005 5

SUSPENSE DATE
10/13

The attached project notification is being referred to your agency in accordance with Office of Management and Budget Circular A-95. This System coordinates the review of proposed Federal or federally assisted development programs and projects. Please provide comments below, relating the proposed project to the plans, policies, and programs of your agency. All comments will be reviewed and compiled by the State Clearinghouse. Any questions may be directed to this office by phone at 758-2946. Please return this form prior to the above suspense date to:

State Clearinghouse
Division of Administration
1205 Pendleton Street
Columbia, South Carolina 29201

Signature: Elmer E. Whitten Jr.
Name, Number: Whitten, Jr.

RESULTS OF AGENCY REVIEW

- ☐ PROJECT CONSISTENT WITH AGENCY PLANS AND POLICIES
- ☐ AGENCY REQUESTS CONFERENCE TO DISCUSS COMMENTS
- ☒ AGENCY COMMENTS ON CONTEMPLATED APPLICATION AS FOLLOWS:

OCT 10 1975
DIVISION OF ADMINISTRATION

We have reviewed the Draft Environmental Statement by the Corps of Engineers for maintenance dredging of the Atlantic Intracoastal Waterway in South Carolina and offer the following remarks.

The draft statement appears to be fairly comprehensive regarding discussion of the major environmental aspects and alternatives of the proposed project.

The following are specific comments on various sections of the draft environmental statement.

1. On page 32 (2.09.02.2) American beach grass (Ammophia breviligulata) is listed as a typical dune plant. Although this plant is prevalent in North Carolina sand dunes, the natural occurrence of beach grass

(Use separate continuation sheets if necessary)

FOR THE REVIEWING AGENCY:
SIGNATURE: [signature] DATE: October 6, 1975
TITLE: Executive Director PHONE: 758-8336

DOA Form 7 (4/15/74)

South Carolina
Project Notification & Review System

PROJECT NOTIFICATION NUMBER

RECEIVED OCT 22 1975

STATE APPLICATION IDENTIFIER

Clearinghouse Use Only
CONTROL NUMBER
DATE NO. FY

DISPENSE DATE
10/31

[illegible] agency in [illegible] agency [illegible] federally assisted development programs [illegible] Please provide comments below relating the proposed project to the plans, [illegible] and programs of your agency. All comments will be reviewed and compiled by the [illegible] perspective. Any questions may be directed to this office by phone at 758-2940.

Please return this form prior to the above suspense date to:

State Clearinghouse
Division of Administration
1205 Pendleton Street
Columbia, South Carolina 2920[illegible]

Signature: Elmer C. Whitten Jr.
Name: Elmer C. Whitten, Jr.

RESULTS OF AGENCY REVIEW

☐ PROJECT CONSISTENT WITH AGENCY PLANS AND POLICIES

☐ AGENCY REQUESTS CONFERENCE TO DISCUSS COMMENTS

☒ AGENCY COMMENTS ON CONTEMPLATED APPLICATION AS FOLLOWS:

The Institute of Archeology and Anthropology, University of South Carolina, has reviewed the "Draft Environmental Statement, Maintenance Dredging of Atlantic Intracoastal Waterway, South Carolina" We find the statement on page 55 "Archeological Sites" to be totally inadequate. What is said is correct but that significant sites are known to be on the banks of the project area. Sites that are not known are expected to be found along the banks of the Intracoastal Waterway throughout its entire length. Some of those sites, we are now learning, were damaged by the original dredging of the waterway and are being further damaged now by wave action in normal use of the Waterway. Spoil areas may also damage sites.

In addition, in places where the Intracoastal Waterway goes through natural water courses such as rivers, bays, inlets, etc., underwater

(see continuation sheet.)

(Use separate continuation sheets if necessary)

FOR THE REVIEWING AGENCY:
SIGNATURE: Robert L. Stephenson DATE: October 10, 1975

TITLE: Director and State Archeologist PHONE: 777-8170

30A Form 7 (4/15/74)

BOARD MEMBERS

Lachlan L. Hyatt Chairman
William M. Wilson Vice Chairman
[illegible] Newman Secretary
W. A. Barnette Jr.
Leonard W. Douglas M.D.
[illegible] Mason Jr. M.D.
A. [illegible] C. Moore Jr. D.M.D.

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL

E. KENNETH AYCOCK M.D. M.P.H. COMMISSIONER
J. MARION SIMS BUILDING — 2600 BULL STREET
COLUMBIA, SOUTH CAROLINA 29201

[illegible]

[illegible]

[illegible] authorize[illegible]

[illegible] removes silt [illegible] the United States [illegible] any mosquitoes [illegible] the state and the [illegible] We believe the riparian, contracting agency, i.e. the [illegible] responsibility [illegible] in mosquito control [illegible] by their performance of their delegated function. [illegible] when these mosquito control [illegible]

Colonel Harry S. Wilson
Page Two
November 12, 1975

This responsibility for and participation in mosquito control has not been satisfactorily discharged until the Corps shall have made every effort to secure adequate funds earmarked in advance for this specific problem and committed those funds either to a coordinated mosquito control program or to the existing local mosquito control program.

In view of these circumstances, we strongly object to this project.

Sincerely,

[illegible]

cc: Senator Strom Thurmond
Senator Ernest F. Hollings
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

[illegible] 1976

[illegible]

South Carolina
Project Notification & Review System

STATE APPLICATION IDENTIFIER
Clearinghouse (State) CONTROL NUMBER
STATE NO. FY

RECEIVED OCT 22 1975

RESPONSE DATE 10/22

[illegible] agency in [illegible] of [illegible] programs [illegible] project to the plans, [illegible] be reviewed and compiled by the [illegible]. Any questions may be given to this office by phone at 758-[illegible]. Please return this form prior to the above suggested date to:

State Clearinghouse
Division of Administration
1205 Pendleton Street
Columbia, South Carolina 29201

Signature: Elmer C. Whitten Jr.
Name: Elmer C. Whitten, Jr.

RESULTS OF AGENCY REVIEW

☐ PROJECT CONSISTENT WITH AGENCY PLANS AND POLICIES

☐ AGENCY REQUESTS CONFERENCE TO DISCUSS COMMENTS

☒ AGENCY COMMENTS ON CONTEMPLATED APPLICATION AS FOLLOWS:

The Institute of Archeology and Anthropology, University of South Carolina, has reviewed the "Draft Environmental Statement, Maintenance Dredging of Atlantic Intracoastal Waterway, South Carolina" We find the statement on page 55 "Archeological Sites" to be totally inadequate. What is said is correct but that significant sites are known to be on the banks of the project area. Sites that are not known are expected to be found along the banks of the Intracoastal Waterway throughout its entire length. Some of these sites, we are now learning, were damaged by the original dredging of the waterway and are being further damaged now by wave action in normal use of the Waterway. Spoil areas may also damage sites.

In addition, in places where the Intracoastal Waterway goes through natural water courses such as rivers, bays, inlets, etc., underwater (see continuation sheet.)

(Use separate continuation sheets if necessary)

FOR THE REVIEWING AGENCY:
SIGNATURE: Robert L. Stephenson DATE: October 10, 1975
TITLE: Director and State Archeologist PHONE: 777-8170

DOA Form 7 (4/15/74)

BOARD MEMBERS

[illegible]

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL

E. KENNETH AYCOCK, M.D., M.P.H., COMMISSIONER
J. MARION SIMS BUILDING — 2600 BULL STREET
COLUMBIA, SOUTH CAROLINA 29201

[illegible], 1975

[illegible]

[illegible] Draft Environmental Impact Statement [illegible]

[illegible]

[illegible] dredging [illegible] from localized natures [illegible] dredging [illegible] included. If dredging [illegible] treatment in the area, then [illegible] systems may not be [illegible] subsequent dredging.

[illegible] will not be affected [illegible] would be [illegible] movement of [illegible] and claim building sites would be harmed.

[illegible] though [illegible] upland disposal of dredged material from [illegible] containing contaminated sediment [illegible] or recommendation is made reflecting what will actually be done. I recommend clarification of this issue.

Thank you for the opportunity to comment on the draft statement.

Sincerely yours,

Gaston F. Sansbury
Manager, Environmental Analysis Section
Program Development Division

[illegible]

ENVIRONMENTAL DEFENSE FUND

1525 18th STREET NW. WASHINGTON, D.C. 20036 202 833-1484

October 28, 1975

Colonel Harry S. Wilson, Jr.
District Engineer
Corps of Engineers
P.O. Box 919
Charleston, South Carolina 29402

Re: Draft Environmental Impact Statement, Maintenance Dredging of Atlantic Intracoastal Waterway, South Carolina

COMMENTS OF THE ENVIRONMENTAL DEFENSE FUND

1. The Environmental Defense Fund, Inc. (EDF) is a not-for-profit, public-interest membership corporation, organized under the laws of New York, with its principal office at 162 Old Town Road, East Setauket, New York 11733. The interests of its approximately 40,000 active members, some of whom reside in or use the natural resources of South Carolina, are represented by a staff of lawyers, scientists, and other professionals dedicated to the enhancement of environmental quality and the prudent use of natural resources.

2. On September 15, 1975, the Charleston District issued the draft environmental impact statement (DEIS) for the above-styled Federal action, pursuant to the National Environmental Policy Act of 1969. Comments of interested parties were invited for consideration and are due by November 10, 1975. EDF's comments follow.

3. The construction of the Atlantic Intracoastal Waterway was authorized by various Rivers & Harbors Acts, noted in the DEIS, and its maintenance is subject to provisions of NEPA, the Fish & Wildlife Coordination Act, and Section 404 of the Federal Water Pollution Control Act Amendments of 1972 (hereinafter the "1972 Amendments"). Save Our Sound Fisheries Assn. v. Callaway, 387 F. Supp. 292 (D.R.I., 1974), NRDC v. Callaway, 392 F. Supp. 685, (D.C.D.C., 1975).

The basic objective of the 1972 Amendments is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Section 404 requires that

[illegible]

permits for discharge of dredged and fill material into waters of the United States be issued based on the application of criteria comparable to those under Section 403(c) of the Act. The focus of the Section 403(c) criteria is to minimize water quality degradation and insults to the integrity of water resources by, inter alia, conducting discharge activities in such a way as to avoid adverse environmental impacts through the use of alternative methods and disposal sites. Section 403 (c)(2)(F).

4. The continuing maintenance of the Intracoastal Waterway raises four separate but related issues which are relevant to the basic objective of the 1972 Amendments and to the specific concerns of Sections 404 and 403. Each of these issues must be examined thoroughly and quantitatively in the environmental impact statement required by NEPA. Environmental Defense Fund v. Hardin, 325 F.Supp. 1401 (D.C.D.C. 1971), Lathan v. Volpe, 350 F.Supp. 262, 265 (W.D. Wash. 1972). The comments on the DEIS which follow are arranged for clarity under the issue to which they specifically relate.

ISSUE I -- ALTERNATIVES TO MAINTAINING THE CHANNEL AT A DEPTH OF 12 FEET MLW

5. A channel should not be maintained by dredging at a depth greater than necessary to satisfy reasonable navigation requirements since this would contradict the objective of Sections 404 and 403 to minimize water resource degradation. The DEIS does not contain enough information to justify the need for a 12 foot channel and, thus, it cannot be determined whether the project as proposed would be consistent with the 1972 Amendments. (1)

The evidence presented in the DEIS does suggest, however, that a 12 foot channel may not be necessary to meet reasonable navigation requirements. For example, Table 1 (page 2) identifies the "controlling dimensions" of the waterway as of September 1974. Many segments of the waterway are shown to be less than 12 feet deep. Table 9 (page 60) demonstrates that waterway traffic increased during the period 1971 through 1973. (2)

Assuming that "controlling dimensions" means existing conditions, Tables 1 and 9 suggest that waterway traffic has actually multiplied despite the shoaling of the channel to existing depths. From this one can conclude that it does not appear necessary to maintain a 12 foot channel to satisfy navigation requirements. (2)

On the other hand, assuming that "controlling dimensions" means the depth necessary to meet navigation requirements, it

is apparent that there exists no need to maintain the channel at a depth greater than the shallowest segment (9.1 feet MLW between Dewee's Inlet and Ben Sawyer's Bridge).

Either way, the need for a 12 foot channel has not been justified on the basis of navigation requirements. (2)

6. The DEIS does not adequately examine alternatives to the proposed 12 foot channel in terms of both environmental and economic costs/benefits. To illustrate this inadequacy we offer the following hypothetical. (1)

Suppose that only a minute proportion of waterway traffic actually requires a 12 foot channel and that the great proportion of users could safely navigate a 10 foot channel. If 4 feet of spoil must be dredged from the channel to maintain a depth of 12 feet, then only 2 feet of spoil would have to be dredged to maintain a 10 foot channel -- a 50% reduction in the amount of dredging and spoil disposal capacity required. In this case, half the environmental and economic costs of maintenance would benefit only a small proportion of users whereas the other half of the costs would benefit the great majority of traffic. (1)+(3)

While these figures are hypothetical, they illustrate the principle that the "reasonableness" of navigation requirements is a function of the relationship between marginal public maintenance costs (both economic and, importantly, environmental) and private navigation benefits. In the above example, it would appear patently unreasonable to double the costs of maintenance to furnish a small increment of benefit to a narrow class of potential waterway users. (1)

Without a marginal (incremental) cost/benefit analysis of the type posed in our hypothetical one cannot determine either the reasonableness of navigation requirements or, as a result, whether an alternative channel depth would be more consistent with the objective of the 1972 Amendments to minimize water resource degradation. (1)

We suggest that the following rough comparison table outlines the type of marginal cost/benefit information which is necessary to evaluate alternative project depths:

BOARD MEMBERS

[illegible]

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL

E. KENNETH AYCOCK, M.D., M.P.H., COMMISSIONER
J. MARION SIMS BUILDING — 2600 BULL STREET
COLUMBIA, SOUTH CAROLINA 29201

[illegible]

[illegible]

[illegible]

CHANNEL DEPTH	8'	9'	10'	11'	12'
% TOTAL TRAFFIC ACCOMMODATED BY CHANNEL (BASELINE ___)					
% PETROLEUM % COMMERCIAL					
BENEFITS ($)					
[illegible] OF MAINTENANCE DREDGED					
ANNUAL MAINTENANCE DREDGING REQUIREMENTS (Yds³/Year)					

ISSUE II -- MEASURES TO MINIMIZE THE ADVERSE IMPACTS OF THE DREDGING OPERATION ITSELF

7. Regardless of channel depth, dredging should be performed so as to minimize its immediate and long-term adverse impacts on water resources, again consistently with the 1972 Amendments. The DEIS does not discuss specifically the adverse impacts of dredging or measures by which such impacts could be reduced.

Paragraph 4.02 (page 62) notes that a "subsurface [turbidity] plume may extend several hundred feet either upstream or downstream as determined by tidal currents." In view of the rather extraordinary tidal amplitude along the South Carolina coast (Table 4, page 26) one would expect turbidity plumes to reach their maximum extension in this region. Yet there is no discussion of the possible use of turbidity curtains and similar devices to minimize the potential adverse impacts of widely dispersed turbidity. (5)

8. Paragraph 4.03.03.4 (page 65) states that "Fish species which would have the highest probability of being affected [by turbidity] are the filter feeders (primarily menhaden herring, and shad) and juvenile forms." It also notes that larval forms are likely to be directly affected by mechanical dredging, turbidity, and the release of toxic substances into the water column.

One possible method of reducing the adverse impacts described above would be to schedule the dredging operation in such a way as to avoid spawning and rearing cycles of the principally susceptible forms and species. Yet the DEIS presents no information on the life cycles of these species from which it can be determined whether the dredging schedule should be modified accordingly. (Proper scheduling might also reduce turbidity impacts by avoiding spring tidal phases.) (6)

9. The conclusion in paragraph 4.03.01.3 (page 64) that "the overall long-term impact on benthic invertebrates will be insignificant" is not supported by the study cited in the preceding paragraph, as is implied. Given that recovery of benthic species was shown to take from 1 to 2 years (a finding also supported by Boyd, et al., 1972), and that dredging frequency in the South Carolina Intracoastal has been on the order of every 1 to 3 years (Table 2, page 7), is it not likely that the benthos will never completely recover? And is this not a significant impact of continuous maintenance dredging? (7)

Decreasing the frequency of dredging could reduce the adverse impact on benthic fauna (not to mention the adverse impact of spoil disposal). Yet the effectiveness and significance of mitigation measures such as less frequently dredging are not discussed in the DEIS. Parenthetically, in view of the statement in paragraph 4.02.01 (page 62) that daylight intensity decreases with the depth of the channel, it may also be the case that a shallower channel would result in faster recolonization of benthic plants by increasing the rate of photosynthesis. (8)

ISSUE III -- TREATMENT AND DISPOSAL ALTERNATIVES FOR TOXIC SEDIMENTS FOUND IN THE CHANNEL

10. Paragraph 2.07.02.1 (page 27) and Table 5 (page 28) list segments of the waterway in which concentrations of toxic substances in channel sediment exceed EPA criteria. The DEIS states that EPA concluded that these sediments should be deposited "above the high water mark" to avoid their re-introduction into the water.

The specific fate of these sediments has not been discussed in the DEIS. No attention was given to pre-treatment, to specific disposal sites, and in particular to the question of how far above the "high water mark" spoils should be placed to avoid re-introduction by abnormally high tides and storm surge. The specific chemical and biological impacts of increasing concentrations of these toxic substances (assuming that they are not effectively isolated from the water by removal or proper deposition) also has been ignored.

Under EPA guidelines issued pursuant to Section 404 (40 Fed. Reg. 41292, September 5, 1975) contaminated spoils must undergo prescribed analysis to determine appropriate alternatives for treatment and discharge. A thorough discussion of the items noted above is necessary to conform to the requirements of the 1972 Amendments. (9)

ISSUE IV -- ALTERNATIVE SPOIL DISPOSAL SITES UNDER SECTION 404

11. Perhaps the most serious shortcoming of the DEIS is its failure adequately to delineate and describe specific spoil disposal sites proposed for immediate and long-term use. Detailed information on specific shoals is presented at pages 9 through 11, but a comparable effort has not been made with respect to disposal sites. Without this detailed information it is simply impossible adequately to address the question of the least environmentally degrading site alternatives, consistently with the objective of the 1972 Amendments. (10)

Paragraph 2.09.04.2.6 (page 47) states that marshland is typically arranged into four distinct zones, each presumably different in terms of value and importance to the integrity of the ecosystem. A description of specific disposal sites should include discussion of the relative importance of each in ecological terms and the extent of damage which can be expected. Maps and graphic representations would be very useful in comparing the site alternatives. Those which are furnished do not delineate the schedule or extent of use. (11)

12. Paragraph 6.02 (pages 72-73) repeatedly asserts that various alternative disposal methods and sites -- e.g., upland, open water, beach, ocean -- would be more costly to use than proposed marsh sites. None of these assertions are supported by detailed cost/benefit data. In view of the statement in paragraph 6.02.04 that "An 18-inch pipeline dredge (largest dredge commonly used on the AIWW) is most efficient and economical at pumping distances up to about 5000 feet" it would appear, contrary to the bald assertions about excessive cost, that alternatives to the use of the state easements would be economically feasible. The easements, according to paragraph 4.01 (page 61), extend only 1000 feet from the channel, or only one-fifth the distance at which the 18-inch dredge is said to operate economically. (12)

Further, in light of the foregoing, the statement in paragraph 4.01 to the effect that a "dilemma" arises as a result of "the lack of funds for the State and Federal government to implement alternative dredging procedures" is wholly unpersuasive. Again, we invite your attention to the discussion of Issue I which, in the context of the asserted lack of funds to pursue less environmentally damaging disposal alternatives, raises anew the question of whether the subsidy to waterway users or certain classes thereof should be reduced in favor of investing in better disposal (13)

practices. It is not sufficient, for purposes of complying with the requirements of NEPA that all agencies consider environmental factors equally with economic ones, merely to assert that there is a lack of funds for environmental protective measures but sufficient funds for the dredging program itself. See also, paragraph 1.04.01. The maintenance dredging of the Intracoastal Waterway must be regarded as a project with multiple objectives, one of which is navigation and another, certainly, environmental protection. See, Calvert Cliffs' Coord. Comm. v. AEC, 449 F.2d 1109, 1112 (D.C.Cir.1971). Thus, the question of how to allocate available funds should be answered with both objectives considered equally in determining the scope of work and procedures to be used. (13)

13. Another related shortcoming of the DEIS is the failure to detail the legal arrangements with the State of South Carolina under which the Corps is permitted to use spoil disposal easements extending 1000 feet from the waterway. An implicit assumption of the DEIS seems to be that other disposal site options are foreclosed as a result of this arrangement. Yet this assumption is never justified and nowhere is it explained just how this result necessarily obtains. The options of the State with respect to securing other easements, if necessary at all, and the extent to which the State has been cooperative in attempting to secure other arrangements have not been discussed. Since the maintenance of the Intracoastal Waterway benefits the citizens and industries of South Carolina, it seems reasonable that the State share the responsibility of accomplishing the equally important project objective of environmental protection. The Charleston District and the State of South Carolina mutually should be exploring alternative disposal site alternatives pursuant to the objective of the 1972 Amendments. (14)

14. Nowhere in the DEIS is there discussed the question of benefits to private citizens which could accrue where spoil disposal create new fastlands from marsh. The legitimacy of conferring distinctly private benefits through a public works project using public funds should be justified. The relevance of this inquiry extends beyond the academic legitimacy of such benefits to the broader and perhaps more significant question of the potential uses to which the new fastlands may be put. Any use of newly-created fastland should be consistent with principles of sound ecological management of the coastal zone. The question of imposing appropriate limitations on the use by private parties of fastlands created with public funds, by conditional agreements, should be fully examined. (15)

MISCELLANEOUS COMMENTS

15. Although paragraph 2.02 describes a number of other Federal projects within the jurisdiction of the Charleston District, the spoil disposal requirements and the cumulative environmental impact of these projects is not discussed in the DEIS as NEPA requires. The maintenance of the Intracoastal Waterway, as the DEIS implicitly recognizes, must not be examined in (16)

CHANNEL DEPTH	8'	9'	10'	11'	12'
• TOTAL TRAFFIC ACCOMMODATED IN CHANNEL (BASELINE)					
• ECONOMIC COMMENTS					
BENEFITS					
[illegible]					
[illegible]					
[illegible]					

4

ISSUE II -- MEASURES TO MINIMIZE THE ADVERSE IMPACTS OF THE DREDGING OPERATION ITSELF

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herring, and shad) and juvenile forms." It also notes that larval forms are likely to be directly affected by mechanical dredging, turbidity, and the release of toxic substances into the water column.

One possible method of reducing the adverse impacts described above would be to schedule the dredging operation in such a way as to avoid spawning and rearing cycles of the principally susceptible forms and species. Yet the DEIS presents no information on the life cycles of these species from which it can be determined whether the dredging schedule should be modified accordingly. (Proper scheduling might also reduce turbidity impacts by avoiding spring tidal phases.)

6

9. The conclusion in paragraph 4.03.31.3 (page 64) that "the overall long-term impact on benthic invertebrates will be insignificant" is not supported by the study cited in the preceding paragraph, as is implied. Given that recovery of benthic species was shown to take from 1 to 2 years (a finding also supported by Boyd, et al., 1972), and that dredging frequency in the South Carolina Intracoastal has been on the order of every 1 to 3 years (Table 2, page 7), is it not likely that the benthos will never completely recover? And is this not a significant impact of continuous maintenance dredging?

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isolation and neither should its adverse impact on coastal resources. Further, the cumulative impact of private projects of this type, including both those which have been and those which are likely to be activated by the Intracoastal Waterway, has not been discussed.

(16)

...the failure of the Corps to discuss [illegible] ecology and wildlife [illegible] is a violation of [illegible] time inasmuch as they [illegible] of the environmental impact analysis. In our opinion [illegible] should contribute the [illegible] an in depth [illegible] an adequate basis [illegible] to occur [illegible] various [illegible]

(17)

[illegible] submitted.

Edw. Thompson Jr.

Edward Thompson, Jr.
Wetlands Monitor

[illegible]

Mr. [illegible], U.S. Fish and Wildlife Service
[illegible]

Mr. [illegible], Director
[illegible] Water Resources Comm.
1414 Gadsden Street
Columbia, S.C. 29202

Mr. [illegible]
[illegible]

LTC John R. Hill, Jr.
Office of Chief of Engineers
Forrestal Bldg., Rm 4G-065
Washington, D.C.

James T.B. Tripp, EDF Counsel
E. Setauket, N.Y.

ENVIRONMENTAL DEFENSE FUND

[illegible] 10th STREET, N.W. WASHINGTON, D.C. 20036 (202) 833-1484

December 3, 1973

[illegible] Engineers
[illegible]
[illegible]
[illegible]
Charleston, South Carolina 29401

[illegible] Fish and Wildlife Service
[illegible] Intracoastal Waterway, 8th Navigation

Dear Colonel [illegible]:

[illegible] is [illegible] public notice [illegible] as we understand it is the first [illegible] Intracoastal Waterway. This material [illegible] has been made available to EDF.

[illegible] notice of October 25, 1973, we noted [illegible] discussion of the [illegible] and private dredging [illegible] Further, comment [illegible] page [illegible]. The [illegible] Corps of Engineers, [illegible] 1972), [illegible], 2nd Cir. [illegible], in which [illegible] Manhattan, held that the Navy Department, as the lead agency on a dredging project, was required to [illegible] impact of such other projects if their [illegible] is beyond the state of mere speculation, even if not finally approved.

We invite your attention to this relevant case and reemphasize our comment which it supports.

Respectfully,

Edward Thompson, Jr.
Wetlands Monitor

LT:e
encl: 1
cc:

Mr. Jack E. Ravan, Reg. Adm., EPA; Mr. Curtis A. Laffin, USFWS; Mr. Randall P. Cheek, NMFS, Mr. Clair P. Guess, Jr., S. Carolina Water Resources Comm.; Mr. Brian Blackwelder, S. Car. Env. Coal.; Mr. Kenneth Black, Reg. Dir., USFWS; LTC John R. Hill, Jr., Corps of Engineers; James T.B. Tripp, EDF Counsel.

of the Navy; CAPT C.C. HUDSON as Commanding Officer, Northern Division, Naval Facilities Engineering Command, Department of the Navy; RUSSELL E. TRAIN as Administrator of the U.S. Environmental Protection Agency; and JOHN A.S. McGLENNON as Regional Administrator, Region I, U.S. Environmental Protection Agency, No. 75-7018, September 9, 1975

WATER

1. Federal, state, and local regulation — Administrative agencies — Judicial review — In general (§28.611)

Court jurisdictions and procedure — In general (§10.01)

District court ... Federal Water Pollution Control Act ... from 404 ... alleged ... conjunctive ... cleaned Water ... under general ... Administrative Procedure Act

2. Federal, state, and local regulation — Administrative agencies — In general (§28.601)

Corps of Engineers voluntary application of part of ocean dumping criteria, 40 CFR 220 et seq. to Navy's dumping project in inland waters of Long Island Sound, makes that part of criteria relied upon by Corps enforceable against Corps

3. Federal, state, and local regulation — Administrative agencies — In general (§28.601)

Navy is appropriate author for National Environmental Policy Act environmental impact statement on dumping project that was essentially Navy project, and Navy's delegation of its NEPA impact statement duty to independent consultant that had no interest in project and was fully responsible to Navy for impact statement shortcomings, is acceptable

4. Federal, state, and local regulation — Administrative agencies — In general (§28.601)

National Environmental Policy Act is not satisfied by Navy's environmental impact statement on dumping project in Long Island Sound that failed to discuss other *dumping* and dredging projects in same area and their cumulative environmental impacts, that failed to present comprehensible and thorough discussion of all alternative dumping sites suggested by Navy and criteria for choosing one site over others, and whose addendum evaluating change in primary dump site failed to compare sites and explain Navy's choice

STATUTES

Federal — National Environmental Policy Act — Impact statement adequacy (§95.0113)

Federal — Federal Water Pollution Control Act (§95.021)

Construed

Environmental and citizen groups appeal from district court's ruling that it lacked jurisdiction under FWPCA to hear suit seeking injunctive relief against Navy's dumping project in Long Island Sound.

Reversed in part and remanded.

Boyle, Buzzel and Kass, New York, and Parmelee, Jacobson and Lee, Stamford, Conn. (Albert K. Butzel, Hewes N. Johnson, Peter J. Millock, of counsel), for plaintiff-appellants.

Wallace H. Johnson, assistant attorney general, Washington, D.C. (Jacques B. Gelen, Kathryn A. Oberly, Department of Justice, of counsel), for defendants-appellees.

Louis J. Lefkowitz, attorney general of the state of New York (Samuel A. Hirshowitz, first assistant attorney general, Philip Weinberg, John J. Shea, IV, assistant attorneys general, of counsel), for intervenor-appellant.

Full Text of Opinion

Before Clark, *Associate Justice*,* Mansfield and Mulligan, *Circuit Judges*.

Mansfield, *Circuit Judge*:

The Natural Resources Defense Council, Inc., Environmental Defense Fund, Inc., The Long Island Sound Taskforce, The Fishers Island Civic Association Inc. along with other environmental and citizen groups, brought this action in the District of Connecticut against the Secretary of the Army, the Secretary of the Navy and other related federal officials seeking declaratory and injunctive relief against further dumping by the United States Navy of highly polluted dredged spoil at the New London

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* Supreme Court of the United States, retired, sitting by designation.

(16)

(17)

Edward Thompson Jr.

ENVIRONMENTAL DEFENSE FUND

In our formal [illegible] we [illegible] that the EIS did not include a discussion of [illegible] permit by [illegible] other federal activities [illegible] in the area under study. See, Comment #5, page [illegible] recent [illegible] Circuit [illegible] of [illegible] 1180-81, (4th Cir. 1975), in which the [illegible] held that the Navy Department, as the lead agency [illegible] project, must address the impact of such other projects if their realization is beyond the state of mere speculation, even if not finally approved.

We invite your attention to this relevant case and re-emphasize our comment which it supports.

Respectfully,

Edward Thompson, Jr.
Wetlands Monitor

Ltr:e
encl: 1
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Mr. Curtis A. Laffin
[illegible]
[illegible]

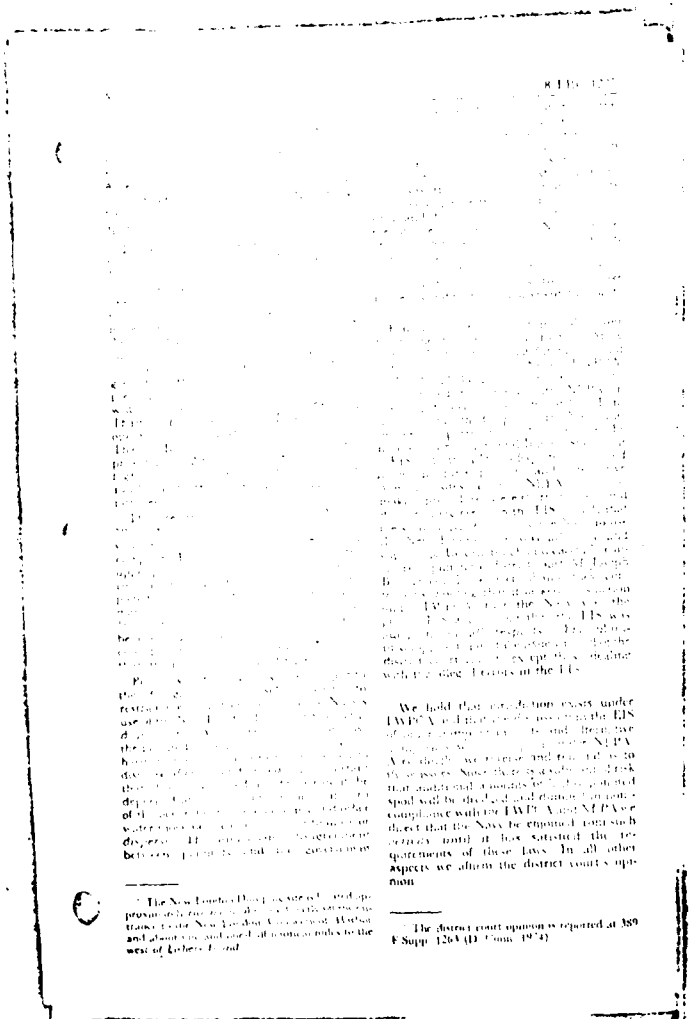
Mr. Randall P. Cheek
National Marine Fisheries Service
Beaufort, North Carolina

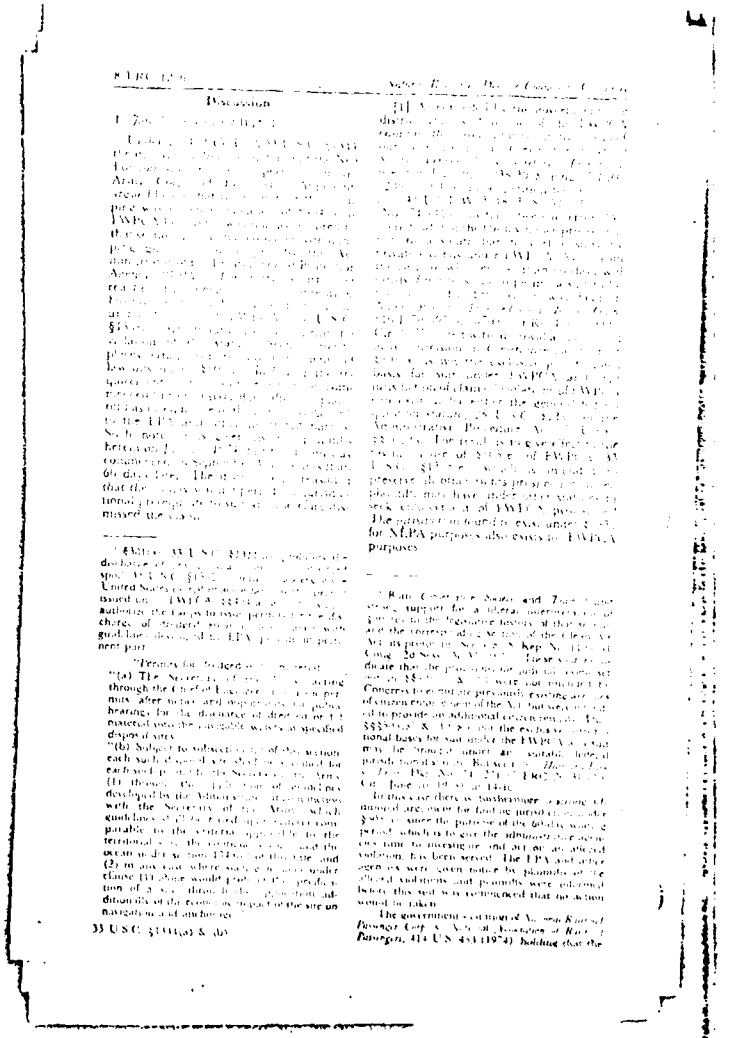
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Mr. Brian Blackwelder
S. Carolina Env. Coalition
Box 1561
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LTC John S. Hill, Jr.
Office of Chief of Engineers
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Washington, D.C.

[illegible], Dir. Counsel
[illegible], D.C.





court who would have the benefit not only of observation of the witnesses who have already testified but also of such additional expert testimony as the two agencies presented at the *Natural Resources Defense Council v. Callaway* hearing. Furthermore, should the district court conclude on further Navy dumping on the New London site would violate the Ocean Dumping criteria which have been authorized to be applied as guidelines it may then be called upon to determine whether the Corps is able to sustain its burden of showing that selection of the New London site as distinguished from some other alternative site which satisfies the Criteria (as to the case of the New London site's evaluation impact on navigation and anchorage

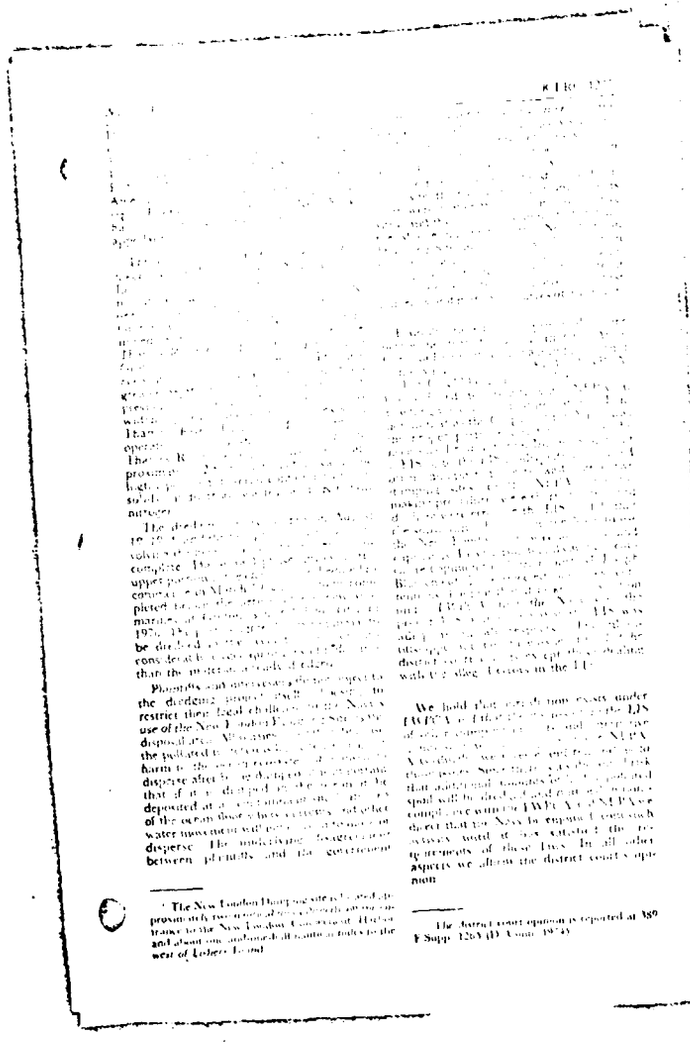
2 *Authority over EIS*

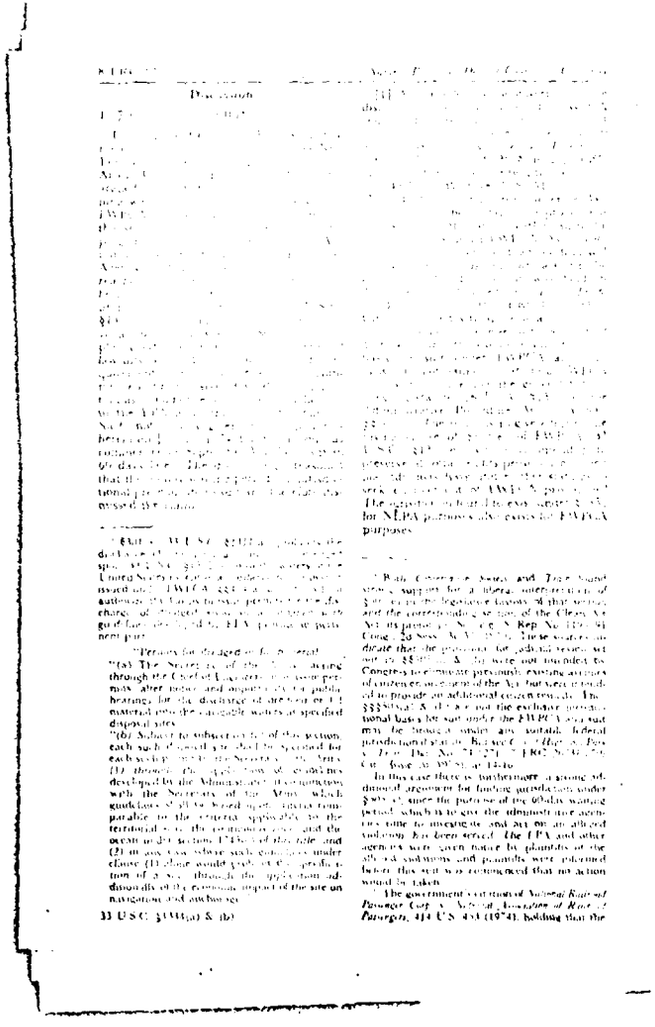
The plaintiffs next contend that because the Army Corps EIS [illegible] prepared by the Navy it violates the letter of NEPA 42 U.S.C. §4332 [illegible] that an EIS [illegible] the same responsible official [illegible] Plaintiffs [illegible] 33 U.S.C. §1413 [illegible] environmental [illegible] the project [illegible] of disposal [illegible] whereas the Navy was a mere participant and [illegible] federal actions [illegible] project [illegible]

[3] [illegible] state of a project [illegible] deed have been [illegible] EIS. Our decisions [illegible] *Southern Louisiana* [illegible] *tion Assn.*, 502 F.2d 43, 51–52 (5th Cir. 1974), and *Greene County Planning Bd. v. FPC*, 455 F.2d 412, 425–26 (2d Cir. 1972), *cert. denied*, 409 U.S. 849 (1972), clearly hold that a federal agency cannot abdicate its responsibility to independently to evaluate federal actions proposed to it by other, non-federal entities. See *EDF v. Hennessy*, *Burns*, Dkt. No. 74-1854 (7 ERC 2347, 2nd Cir. May 13, 1975), at 3762. Where two or more cooperating federal agencies are the only entities involved in a proposed project, however, the situation is quite different. Each agency participation in the preparation of the EIS is assured. The only issue which arises between federal agencies, should be treated as the "lead" agency responsible for its preparation. The Council on Environmental Quality ("CEQ") has issued Guidelines which allow for the designation of a "lead" agency to prepare the EIS on all aspects of a federal project involving more than one federal agency.* The agencies themselves are to designate the "lead agency," taken into account

"the [illegible] involved. The agencies [illegible] respective [illegible] expertise with respect to [illegible] environmental effects."

[illegible] that the Navy was the [illegible] Army Corps [illegible] Navy [illegible] Army [illegible] Navy [illegible] Army [illegible] Navy [illegible] Army





dredged channel remains at the proper depth and in good repair. See *Upper Bay Association v. Stans*, 452 F.2d 1233, 1236, 3 ERC 1418 (10th Cir. 1971), *writ of certiorari for determination of mootness*, 409 U.S. 924 (1972), *affirmed dismissal as moot*, 467 F.2d 717 (6 ERC 1931) (10th Cir. 1972). Finally, the district court found that no decision on the relative environmental merits of the two agencies prior to January 1972 had been presented by the parties.

Appellants further argument that the Navy's partial delegation of its duties under the "responsible officer" to a corporation to prepare the EIS violated the decisions in *Conservation Society of Southern Vermont, Inc. v. Secretary of Transportation, et al.*, and *Greene County Planning Board v. FPC*, in that those courts construe our holdings in those cases. Rather than hire its own personnel to prepare the impact statement, the Navy in *this case contracted* out the work to a totally dependent consultant. Navy personnel then prepared a short rough draft of the impact statement and then sent the draft to the consultant along with instructions to expand it on the basis of conclusions and information supplied by the Navy. The draft and final versions of the EIS's also now exist were prepared by the independent consultant with minimal scrutiny by the Navy.

We agree with the district court that this procedure is acceptable in these circumstances and is not prohibited by the decisions relied upon by plaintiff. The evil sought to be avoided by the holdings in *Conservation Society* and *Greene County* is the preparation of the EIS by agents usually a state agency with an individual "axe to grind", i.e., an interest in seeing the project accepted and completed in a specific manner as proposed. Unfortunately, such a biased party might present the fair and impartial evaluation of a project envisioned by NEPA. Here no problem of self-interest on the part of the author exists. As the Navy's lawyer tirelessly pointed out in his oral argument before us, the consultant has no interest but the Navy's to serve and is fully responsible to the Navy for any shortcomings in the EIS. Therefore, we see no difference for NEPA purposes between this procedure and preparation of the EIS by Navy personnel. In both cases the preparers are guided exclusively by the interests of the Navy and the dictates of the NEPA process. See 389 F.Supp. at 1273-74.

3. *Inadequacy of Discussion in the EIS of Cumulative Effects of Navy and Other Dumping Projects*

The Final EIS filed by the Navy discussed and evaluated only the environmental impact of this particular Navy project. It did not mention other pending proposals for the disposal of approximately an additional 2 million cubic yards of polluted spoil from the Navy's London site or of other projects in the Thames River. The Corps of Engineers proposes, subject to approval and funding by Congress, to dredge the channel of the Thames River to a depth of 41 feet, generating approximately 1,400,000 cubic yards of spoil, with the New London site as a likely dumping spot. The United States Coast Guard is considering a draft EIS to remove and relocate its present facilities on the New London site for the disposal of approximately 250,000 cubic yards of spoil. Maintenance of the Thames River channel through 1980 will create approximately an additional 200,000 cubic yards of spoil. The Electric Boat Division of General Dynamics has applied to dredge the channel to remove spoil from the Thames River near its plant and to dump the spoil at the Navy's London site.

The contaminated spoil from these proposed projects and from the Navy's current dredging operations in London and Groton is to be dumped within the area of the New London site the amount of which will exceed the average of approximately 250,000 cubic yards dumped there annually prior to 1972. Indeed the total amount of spoil dumped in the entire Long Island Sound during the first eight months of 1972 was 2.1 million cubic yards.

[4] In view of the failure of the Navy's Final EIS to make any mention whatsoever of all of these proposed projects or to analyze the possible cumulative effects of the Navy's dumping of 2.8 million cubic yards of highly polluted spoil with the prospects for dredging of an additional 2.15 million cubic yards, which must be dumped somewhere, appellants renew their contention rejected below, that the EIS is deficient. We agree that in this respect the EIS failed to furnish information essential to the environmental decision-making process.

The district court concluded that the environmental impact of the Navy's project may be considered in isolation for the reason that the other dumping projects are tentative or speculative in nature and unlike segments of a proposed highway which must be considered as part of one major federal development program; see *Conservation Society of Southern Vermont, Inc. v. Secretary of Transportation, supra*, 508 F.2d at 933-35, the Navy's dumping of spoil is unrelated to that required by other projects. The court further concluded that the Navy's use of the New London site, unlike some federal projects, will not have a "bandwagon effect" leading inevitably to use of the same site for

the dumping output of the other projects, see *Scientists' Institute for Public Information, Inc. v. AEC*, 481 F.2d 1079, 5 ERC 1418 (D.C. Cir. 1973). Although the district court recognized the threat of incremental harm posed by the other proposals for dumping of polluted spoil in the area, 389 F.Supp. 1279-80, it was persuaded that the development of an impact statement for a larger ecosystem was neither feasible nor reasonable. Accordingly the court drew the line at the Navy's single project reasoning that "The duty to discuss the impact of all *possible pollutants, cannot be imposed on* each isolated project." 389 F.Supp. 1280. We believe that this represents too constricted a view of the informative function of an EIS and of the duty of the responsible agency in preparing it. We agree with the Navy that NEPA does not require it to make a "crystal ball" inquiry. *Natural Resources Defense Council, Inc. v. Morton*, 458 F.2d 827, 837 [3 ERC 1558] (D.C. Cir. 1972), and that an EIS is required to furnish only such information as appears to be reasonably necessary under the circumstances for evaluation of the project rather than to be so *all-encompassing in scope that the task of* preparing it would become rather frustrating or well nigh impossible. *Indian Lookout Alliance v. Volpe*, 484 F.2d 11 [5 ERC 1749] (8th Cir. 1973). A government agency cannot be expected to wait until a perfect solution of environmental consequences of proposed action is devised before preparing and circulating an EIS. On the other hand, an agency may not go to the opposite extreme of treating a project as an isolated "single-shot" venture in the face of persuasive evidence that it is but one of several substantially similar operations, each of *which will have the same polluting effect in* the same area. To ignore the prospective cumulative harm under such circumstances could be to risk ecological disaster.

As was recognized by Congress at the time of passage of NEPA, a good deal of our present air and water pollution has resulted from the accumulation of small amounts of pollutants added to the air and water by a great number of individual, unrelated sources.

> "Important decisions concerning the use and the shape of man's future environment continue to be made in small but steady increments which perpetuate rather than avoid the recognized mistakes of previous decades."

S. Rep. No. 91-296, 91 Cong., 1st Sess. 5 (1969). NEPA was in large measure an attempt by Congress to instill in the environmental decisionmaking process a more comprehensive approach so that long term and cumulative effects of small and unrelated decisions could be recognized, evaluated and either avoided, mitigated or accepted as the price to be paid for the major federal action under consideration. E.g., *Natural Resources Defense Council, Inc. v. Morton, supra*, 458 F.2d at 836; see *Scientists' Institute for Public Information, Inc. v. AEC, supra*; *Jones v. Lynn*, 477 F.2d 885, 892 [5 ERC 1969] (1st Cir. 1973). The fact that another proposal has not yet been fully approved, adopted or funded does not *become a "non consideration, since the* pertinence may demonstrate itself in subsequent and implementation is extremely likely.

In recognition of Congress purpose the CEQ Guidelines for preparation of impact statements emphasize that consideration should be given not only to the action that is the subject of the EIS but also to "related Federal actions and projects in the area and *other actions [of the]* [emphasis added]." 40 C.F.R. §1500.6(a), and direct that the "interrelationships and cumulative environmental impacts of the proposed action and other related Federal projects shall be presented in the statement." 40 C.F.R. §1500.8(a). Additionally, the Navy itself has recognized this requirement of broad range consideration and evaluation:

> "The point is that a large overview should be maintained toward the magnitude of environmental effects both of the immediately contemplated action and of future actions for which the proposed action may serve as a precedent or have a cumulatively significant impact."

OPNAVINST 6240.2c, ¶1b (Oct. 4, 1972).

The Navy's impact statement fails to meet this standard of comprehensive evaluation. It is clear that there are at least several other major federal and private dredging projects that are likely to produce substantial amounts of [illegible] in the Thames River and Long Island Sound — the Corps' further deepening of the Thames River channel, the maintenance of that channel, the dredging of the Thames by the Electric Boat Division of General Dynamics and the Coast Guard's Thames River dredging projects. While none of these projects *have gained final approval, all are well* beyond the stage of mere speculation and should have been included in the Navy's analysis of environmental impacts. Admittedly, they are not projects contemplated by the Navy and are not directly related to the Navy's dredging of the Thames in the sense that all are part of the Navy's project.

see Conservation Society of Southern Vermont v. Secretary of Transportation, [illegible] 934-36. On the other hand, all sites [illegible] in the same geographical area [illegible] related to their environmental [illegible] disposal of [illegible] prohibition of [illegible] each [illegible] New London site [illegible] closely connected [illegible] can be expected to produce a cumulative environmental impact [illegible] be evaluated [illegible] *See Jones Inlet, supra*, 477 F.2d at [illegible].

The Navy [illegible] possible [illegible] the New [illegible] isolated [illegible] eliminated by NEPA. [illegible] dredg[illegible] site [illegible] pacts of the projects [illegible] risk of a serious [illegible] quences [illegible] toward [illegible] greater. [illegible] to be d[illegible] foreseeable [illegible] the Navy and the Corps [illegible]

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* The district court [illegible] quired [illegible] have a "[illegible] in Section [illegible] *ABC*, *supra*, at 1225 [illegible] "handicapped [illegible] initial [illegible] further [illegible]

Appellees [illegible] such an [illegible] coincides [illegible] previously [illegible] *32[illegible]* known [illegible] thought [illegible] (Navy Br. New [illegible] Coast [illegible] in its EIS [illegible] the New [illegible] at the New [illegible] would not [illegible] the dumping [illegible] would [illegible] too far [illegible] culty [illegible] have become [illegible]

This [illegible] cumulative [illegible] sidered [illegible] Navy's [illegible] "handicapped" [illegible] of a Navy decision [illegible] site may be similar

include that some other method of disposal such as a containment island large enough to contain the spoil dredged from all future and similar projects, should be urged upon Congress as the only effective way of coping with the problem. The Natural Marine Fisheries Service has pointed out that such containment islands, which are under way in the Great Lakes and Chesapeake Bay areas, not only have environmental benefits but offer economic advantages as well when used on a large scale, since the cost is then shared by several dumping projects. Another approach that might have been considered is one by which the government were required to take a long-range look at the cumulative effect of the various pending projects would be a plan for adoption of a system of allocation of the most [illegible] ocean disposal sites so that the worst [illegible] *spoil could be placed* at the site best [illegible] to contain it. The Navy's piecemeal approach to environmental consideration prevented any such comprehensive planning.

*The Navy seeks to avoid any broad discussion of the cumulative impact of dumping in the New London area on the ground that there is insufficient scientific knowledge about the long term effects of its proposed New London dump, to date projects about the Long Island discussion will fail to enable it to make an assessment. The predictive course, it argues, would be to proceed with the New London project and then to provide suspension if the monitoring program should uncover any adverse impacts. The trouble with this suggestion, as [illegible] it offers [illegible] little and [illegible] to the [illegible] EIS [illegible] objectives [illegible] The monitoring program [illegible] would [illegible] not discover the [illegible] effects until [illegible] of cubic yards of [illegible] spoil had been dumped [illegible] *irreversible decisions* [illegible] to [illegible] to be a [illegible] The [illegible] monitoring program [illegible] is not calculated to measure long-term effects. Whereas the Navy proposes [illegible] a [illegible] the Long Island Sound [illegible] New England River Basin Commission is [illegible] just such a study. Surely the Navy's EIS, despite the present lack of information on cumulative effects, should be required to furnish some information and analysis of the subject rather than postpone the matter for consideration [illegible] [illegible] [illegible]

dredged channel remains at the proper depth and in good repair. See *Upper Bay Association v. Alexander*, 452 F.2d 1233, 1236 (3 ERC 1418) (10th Cir. 1971), *cert. denied sub nom. determination of nuisance*, 409 U.S. 1024 (1972), *aff'd Sampson v. Alexander*, 501 F.2d 17 (6 ERC 1934) (10th Cir. 1974). Finally, the district court found that no [illegible] relative environmental [illegible] between agencies prior to January 1972 had been presented by the parties.

Appellants' [illegible] argument is that the Navy's [illegible] to [illegible] as the "responsible agency" to a [illegible] to prepare the EIS violated [illegible] decisions in *Calvert Cliffs' Coordinating Committee, Inc. v. United States Atomic Energy Commission*, 449 F.2d 1109 (2 ERC 1779) (D.C. Cir. 1971), and *Greene County Planning Board v. Federal Power Commission*, 455 F.2d 412 (3 ERC 1779) (2d Cir. 1972), cert. denied, 409 U.S. 849 (1972). We do not agree that this constitutes our holdings in those cases. Rather than free its own personnel to prepare the impact statement, the Navy in this case contracted out the work to [illegible] dependent consultant. Navy personnel then prepared a draft impact statement and then sent the draft to the consultant along with instructions to expand it on the basis of [illegible] information supplied by the Navy. The draft and final versions of the EIS which now exist were prepared by the independent consultant with minimal [illegible] by the Navy.

We agree with the district court that this procedure is acceptable in these circumstances and is not prohibited by the decisions relied upon by plaintiffs. The real issue sought to be argued by the holdings in *Conservation Society* and *Greene County* is the preparation of the EIS by a party, usually a state agency, with an individual "axe to grind", i.e., an interest in seeing the project accepted and completed in a specific manner as proposed. Authorship by such a biased party might prevent the fair and impartial evaluation of a project envisioned by NEPA. Here no problem of self-interest on the part of the author exists. As the Navy's *brief* [illegible] *admits*, it has no interest but the Navy's to serve and is fully responsible to the Navy for any shortcomings in the EIS. Therefore, we see no difference for NEPA purposes between this procedure and preparation of the EIS by Navy personnel. In both cases the preparers are guided exclusively by the interests of the Navy and the dictates of the NEPA process. See 389 F. Supp. at 1273-74.

3. *Inadequacy of Discussion in the EIS of Cumulative Effects of Navy and Other Dumping Projects*

The Final EIS filed by the Navy discussed and evaluated only the environmental impact of this particular Navy project. It did not mention other pending proposals for the disposal of approximately 60 million cubic yards of dredged spoil from the New London site or of other nearby areas. The Corps of Engineers proposes, subject to approval and funding by Congress, to dredge the channel of the Thames River to a depth of 41 feet, generating approximately 1,400,000 cubic yards of spoil, with the New London site as a likely dumping spot. The United States Coast Guard, according to a draft EIS recently issued by it, proposes to use the New London site for the disposal of approximately 250,000 cubic yards of spoil. Maintenance of the Thames River channel through 1980 will create approximately 2.5 additional 200,000 cubic yards of spoil. The Electric Boat Division of General Dynamics has applied to dredge 40,000 cubic yards from the Thames River to its plant and to dump the spoil at the New London site.

The combined spoil from these proposed projects and from the Navy's proposed [illegible] operations in the Long Island Sound area [illegible] to be disposed of in the New London area the amount would exceed the average of approximately 250,000 cubic yards dumped there each year prior to 1972. Indeed the total amount anticipated under the current Long Island Sound [illegible] during the first eight months of 1977 was 2.1 million cubic yards.

[4] In view of the failure of the Navy's Final EIS to make any mention whatsoever of all of these proposed projects or to analyze the possible cumulative effects of the Navy's dumping of 2.8 million cubic yards of highly polluted spoil with the prospects for dredging of an additional 2.15 million cubic yards, which must be dumped somewhere, appellants renew their contention, rejected below, that the EIS is deficient. We agree that in this respect the EIS failed to furnish information essential to the environmental decision-making process.

The district court considered that the environmental impact of the Navy's project may be considered in isolation for the reason that the other dumping projects are tentative or speculative in nature and unlike segments of a proposed highway which must be considered as part of one master federal development program, see *Conservation Society of Southern Vermont, et al., v. Secretary of Transportation, supra*, 508 F.2d at 931-35, the Navy's dumping of spoil is unrelated to that required by other projects. The court furthermore concluded that the Navy's use of the New London site, unlike some federal projects, will not have a "bandwagon effect" leading inevitably to use of the same site for

the dumping output of the other projects, see *Scientists' Institute for Public Information, Inc. v. AEC*, 481 F.2d 1079 (5 ERC 1418) (D.C. Cir. 1973). Although the district court recognized the threat of incremental harm posed by the other proposals for dumping of polluted spoil in the area, 389 F. Supp. 1279-80, it was persuaded that the development of an impact statement for a larger ecosystem was neither feasible nor reasonable. Accordingly, the court drew the line at the Navy's single project, reasoning that "The duty to discuss the impacts of all possible pollutant cannot be imposed on each isolated project." 389 F. Supp. 1280. We believe that this represents too constricted a view of the informative function of an EIS and of the duty of the responsible agency in preparing it. We agree with the Navy that NEPA does not require "crystal ball" inquiry. *Natural Resources Defense Council, Inc. v. Morton*, 458 F.2d 827, 837 (3 ERC 1558) (D.C. Cir. 1972), and that an EIS is required to furnish only such information as appears to be reasonably necessary under the circumstances for evaluation of the project rather than to be so all-encompassing in scope that the task of preparing it would become either [illegible] or well nigh impossible. *Indian Lookout Alliance v. Volpe*, 484 F.2d 11 (7 ERC 1749) (8th Cir. 1973). A government agency cannot be expected to wait until a perfect solution of environmental consequences of proposed action is devised before preparing and circulating an EIS. On the other hand, an agency may not go to the opposite extreme of treating a project as an isolated "single-shot" venture on the face of persuasive evidence that it is but one of several substantially similar operations, each of which will have the same polluting effect in the same area. To ignore the prospective cumulative harm under such circumstances could be to risk ecological disaster.

As was recognized by Congress at the time of passage of NEPA, a good deal of our present air and water pollution [illegible] from the accumulation of small amounts of pollutants added to the air and water by a great number of individual, unrelated sources.

> "Important decisions concerning the use and the shape of man's future environment continue to be made in small but steady increments which perpetuate rather than avoid the recognized mistakes of previous decades."

S. Rep. No. 91-296, 91 Cong., 1st Sess. 5 (1969). NEPA was in large measure an attempt by Congress to install in the environmental decision-making process a more comprehensive approach so that [illegible] and cumulative effects of small and unrelated decisions could be recognized, evaluated and either avoided, mitigated or accepted as the price to be paid for the support federal action under consideration. E.g., *Natural Resources Defense Council, Inc. v. Morton, supra*, 458 F.2d at 836; see *Scientists' Institute for Public Information, Inc. v. AEC, supra*; *Jones v. Lynn*, 477 F.2d 885, 891 (5 ERC 1969) (1st Cir. 1973). The fact that another proposal has not been finally approved, adopted or funded does not foreclose it from consideration, since experience may demonstrate that [illegible] and implementation is extremely likely.

In recognition of Congress' purpose the CEQ Guidelines for preparation of impact statements "impose a clear responsibility" [illegible] the agency for [illegible] the adequacy of the EIS but also to "reflect Federal actions and plans over the area and not [illegible]." (emphasis added). 40 C.F.R. §1500.6(a), and direct that the "interrelationships and cumulative environmental impacts of the proposed action and other related Federal projects shall be presented in the statement." 40 C.F.R. §1508.8(a). Additionally, the Navy itself has recognized this requirement of broad range consideration and evaluation:

> "The point is that a large overview should be maintained toward the magnitude of environmental effects both of the immediately contemplated action and of future actions for which the proposed action may serve as a precedent or have a cumulatively significant impact."

OPNAVINST 6240.2c, §1b (Oct. 4, 1972).

The Navy's impact statement fails to meet this standard of comprehensive evaluation. It is clear that there are at least several other major federal and private dredging projects that are likely to [illegible] [illegible] [illegible] [illegible] Corps' further deepening of the Thames River channel, the maintenance of that channel, the dredging of the Thames by the Electric Boat Division of General Dynamics and the Coast Guard's Thames River dredging projects. While none of these projects have gained final approval, all are well beyond the stage of mere speculation and should have been included in the Navy's analysis of environmental impacts. Admittedly, they are but projects contemplated by the Navy and are not directly related to the Navy's dredging of the Thames in the sense that all are part of the Navy's project.

subjected to court [illegible] the environmental factors set out in the Addendum to the Final EIS. Def. for the permit's issue and the decision is finalized" the NEPA process is satisfied *and it should not matter* what the Corps "directly" to use a particular site." 389 F Supp 1276

We agree with the district court that the use of supplemental data and statements is permissible to [illegible] otherwise deficient EIS or to amend an EIS [illegible] changes in the proposed action [illegible] "supplementation" [illegible] deficiencies [illegible] proposed [illegible] final [illegible] plicable [illegible] Administrative [illegible] hatchery [illegible] FWPCA [illegible] of such [illegible] supplemental [illegible] changes in [illegible] ing or prior [illegible] is otherwise [illegible] specifically [illegible]

"An agency [illegible] or any recommendation or report on proposals [illegible] statement [illegible] circulated, interpreted, or submitted [illegible] or supplements [illegible] as a basis for [illegible] a [illegible] comment [illegible] the purposes [illegible] recirculated [illegible] purposes [illegible]

40 C.F.R. § [illegible]

[illegible] the [illegible] be made [illegible] calculated [illegible] light [illegible] Otherwise [illegible] NEPA [illegible] [illegible] [illegible]

Similarly, as to the other alternatives actually discussed there is insufficient comparison of the qualities of each site with those of the other sites. At best the statements with respect to each site are conclusory, rather than informative.

By failing to present a complete analysis and comparison of the possible dumping sites, the Final EIS fails to perform its vital task of exposing the reasoning and data of the agency proposing the action to scrutiny by the public and by other branches of the government. See e.g. *Silva v. Lynn*, *supra*, 482 F 2d at 1286, n 7; *Monroe County Conservation Society, Inc. v. Volpe*, *supra*, 472 F 2d at 697. It leaves the reader completely in the dark as to why the New London site was suddenly chosen over Brenton Reef after the latter had been selected as the most suitable site and it gives only sketchy information as to other sites that had been runners-up to Brenton Reef.

5. *Conclusion*

In sum, we hold that the district court has jurisdiction to hear plaintiffs' claimed violation of FWPCA. The Corps of Engineers' voluntary application of part of the Ocean Dumping Criteria makes that part of the Criteria relied upon by the Corps enforceable against it. We affirm the district court's holding that the Navy is the appropriate author for the EIS.

The Final EIS does not meet NEPA standards because of its failure to discuss other dumping and dredging projects in the New London area and their cumulative impact, combined with the Navy's project, on the ocean environment. The Addendum evaluating the change in primary dump site from Brenton Reef to New London fails adequately to compare New London with other dump sites and to explain the Navy's choice. Similarly, the Final EIS fails to present a comprehensible and thorough discussion of all the alternative dumping sites suggested by the Navy and the reasons for choosing New London over the others.

The Navy should not be permitted to proceed with further dumping at the New London site until the FWPCA claim has been resolved and the serious deficiencies in the EIS remedied. Otherwise application of a "rule of reason" would convert an EIS into a mere rubber stamp for post hoc rationalization of decisions already made. If the spirit as well as the letter of NEPA is to have any real meaning in this case the Navy should prepare and circulate for consideration and comment a supplemental statement that will furnish detailed information with respect to (1) other dredging and dumping projects existing and proposed in the New London area and their anticipated cumulative impact, when combined with the Navy's Thames River project, on the ocean's environment. (2) all of the alternative dumping sites proposed in the Revised Draft EIS and Final EIS. The supplemental statement must then make a genuine effort in a truly objective fashion to evaluate and compare the qualities of all of the containment sites and to select one on the basis of clearly stated data and reasoning.

Since the plaintiffs have made out a clear case on the merits and irreparable damage could be caused by resumption of further dumping at the New London site, the district court is directed to issue appropriate temporary injunctive relief designed to maintain the status quo until the FWPCA claim is resolved and the defects in the EIS are remedied.

Reversed in part and remanded for further proceedings consistent with the foregoing.

Mulligan, *Circuit Judge* (dissenting):

On the question of the sufficiency of the EIS I would affirm on the opinion of Judge Blumenfeld below (389 F Supp. 1263 (D Conn. 1974)), which the majority opinion properly characterizes as "thorough and carefully considered." The major issue on this appeal involves the change of the dumping site from its initial locus Brenton Reef to New London. On this point the trial judge who conducted a three-day trial, concluded:

> There was expert testimony at the hearing on this matter that on the basis of present scientific knowledge there is no way to tell whether Brenton Reef or New London is a better site with respect to containment characteristics. This expert evaluation was by Dr. John B. Pearce, who chaired the meetings of the Scientific Advisory Subcommittee, and Dr. Pearce indicated that this opinion was generally shared by that body. . . . The court concludes that the evidence presented is

Final EIS in less than a page. The district court considered this treatment sufficient, assuming that the Navy lacked any further information. However, the record reveals testimony by Prof. Bohlen that testing had been conducted at Site 1 over a period of 4 years and that the site has several attractive containment characteristics, including greater depth than the New London site and a greater distance from the Connecticut coast, thus reducing the risk of destruction of nursery and spawning near the shore.

> enough to meet the relatively light burden placed upon the Navy by the "substantive" standard of review.

Id at 1292 (footnote omitted). This is a question of fact determined below which I cannot characterize as "clearly erroneous" and hence I see no reason for a remand to conduct further protracted hearings.[1]

The record further establishes to my satisfaction that there is a dearth of information with respect to long-term ecological marine damage from sea dumping. This is precisely why the permit issued here was conditioned upon the maintenance of a comprehensive monitoring and environmental effects study on the site administered by the National Oceanographic and Atmospheric Administration. This program has been funded in the sum of $500,000 and is presently in operation. In the event that any significant adverse environmental effects are detected, the disposal permit may be summarily suspended and the disposal operation will be altered or perhaps moved to a different site which the Corps had agreed to begin to study prior to the commencement of disposal at the New London site.[2]

The future ability of the defendants to control the drifting or leakage of the spoilage at the New London site is a factor which cannot be disregarded and must be given weight in assessing the sufficiency of the EIS. *Sierra Club v. Morton*, 510 F 2d 813, 828 [7 ERC 1768] (5th Cir. 1975), *Gulf Oil Corp. v. Morton*, 493 F 2d 141, 144 [6 ERC 1152] (9th Cir. 1973). It is further conceded here that the haulage of the spoilage some 23 miles further to Brenton Reef would entail an additional cost of 7 million dollars. In view of these facts and reading the EIS as supplemented, one cannot reasonably describe the agency decision to utilize New London as "arbitrary or capricious," or an "abuse of discretion." *Chelsea Neighborhood Assns. v. United States Postal Service*, 516 F 2d 378, 387 n 23 [7 ERC 1957] (2d Cir. 1975).

I further disagree with the majority's determination in part 3 of the opinion that the EIS should evaluate the impact of pending proposals as a result of which at some future date other polluted spoil might be dumped at the New London site. In addition to the reasons advanced below, I think it is reasonable to assume that environmental groups will mount further attacks on such projects as assiduously as they have here. It is unrealistic to anticipate projects which have not been finally approved, adopted or funded. Rather, I submit the present dumping at issue here should be considered by those agencies in making their decisions as to whether or not to utilize New London in the future.

I do agree with the majority that the dismissal of the FWPCA count discussed in part 1 of the opinion was improper in view of our decision in *Conservation Society of Southern Vermont, Inc. v. Secretary of Transportation*, 508 F 2d 927, 938-39 & n 62 [7 ERC 1350] (1974). While I agree that our holding there disposes of the time bar issue, I disagree that any remand is necessary. Assuming jurisdiction to review exists under 33 U.S.C. §1365(a), 28 U.S.C. §1331 or the Administrative Procedure Act, 5 U.S.C. §§701-706, the issue is whether or not there is a statement of claim for a violation of 33 U.S.C. §1341. I say none exist where there is no applicable EPA effluent standard in effect at the time the permit was issued. As the record makes clear, Long Island Sound is considered an inland water and the only standards promulgated by the EPA involve ocean dumping criteria. The fact that the

[1] In footnote 7, the majority opinion maintains that the "clearly erroneous" test of appellate review does not apply to our assessment of the adequacy of the EIS since this determination involves the drawing of legal conclusions and inferences from facts citing *Hanly Citizens Concerning Community v. Butz*, 468 F 2d 1244, 1246 [5 ERC 1844] (10th Cir. 1973), *Sierra Club v. Morton*, 510 F 2d 813, 818 (9th Cir. 1975) is contrary. That court held:

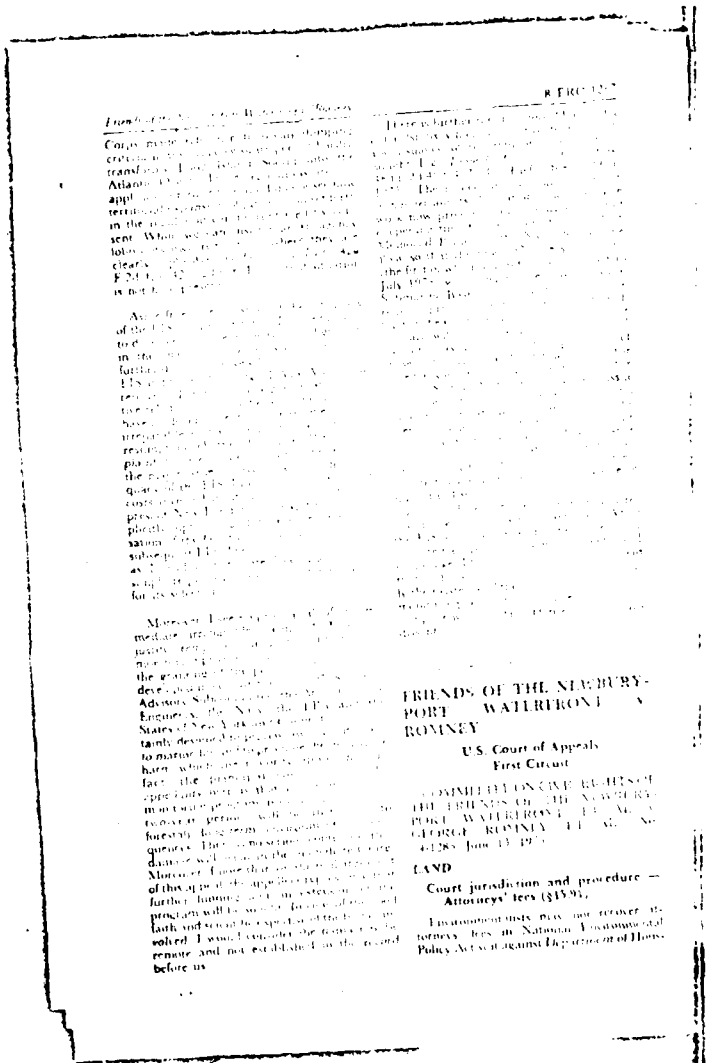
> Having failed to convince the trial court that the EIS was inadequate, the plaintiffs must now demonstrate that the lower court's findings accepting the EIS as adequate and the decision to proceed as permissible were clearly erroneous.

I find no discussion on point in this circuit. When the adequacy of the EIS is questioned because of its alleged failure to properly discuss alternative solutions, their physical viability becomes crucial. That rests upon a question of fact not law, and therefore to that extent the clearly erroneous rule should apply. The non-sea dumping alternatives e.g., total land disposal, dredge soil farming incineration, container disposal and island construction, were definitely discussed and rejected in the revised EIS.

[2] The so-called Acid Site referred to in the majority opinion, which has never been used as a dumping site in the past, was only brought to the Navy's attention after the EIS was filed. In view of the objections of organized fishermen, it has been dropped from further consideration. However, two other sites in Block Island Sound are being studied as alternative locations in the event the New London site proves to be unsafe. The flexibility provided by the monitoring program is persuasive that the claimed insufficiencies of post consideration of alternate proposals in the EIS exalts form over substance.

sidered in good faith the environmental factors set out in the Addendum and in the Final EIS. In fact, the permit was issued after the decision is finalized, the NEPA process is satisfied, and [illegible] the Corps decided to use a portion of the [illegible] 389 F Supp 1275.

We agree with the district court that the use of supplemental information to remedy perceived inadequacies in a draft EIS or the Final EIS [illegible] an the proposed action [illegible] "supplement" [illegible] deficiencies in the Final EIS. [illegible] the Addendum [illegible] the Final EIS [illegible] the Addendum [illegible] the Final EIS [illegible] the Addendum [illegible] the Final EIS



FRIENDS OF THE NEWBURYPORT WATERFRONT v. ROMNEY

U.S. Court of Appeals
First Circuit

LAND

Court jurisdiction and procedure — Attorneys' fees ($15%).

Environmentalists may not recover attorneys' fees in National Environmental Policy Act suit against Department of Housing

before us

SOUTH CAROLINA
environmental coalition
P.O. BOX 5761 COLUMBIA, SOUTH CAROLINA 29250

Colonel Harry S. Wilson, Jr.
Charleston District, Corps of Engineers
P.O. Box 919
Charleston, S.C. 29402

November 7, 1975

Dear Sir,

The South Carolina Environmental Coalition has reviewed the draft environmental impact statement for maintenance dredging of the Atlantic Intracoastal Waterway between Little River, S.C. and Port Royal Sound, S.C. and is submitting the following comments to the Charleston District office based on our review.

The South Carolina Environmental Coalition is a statewide non-profit environmental organization, composed of individuals and organizations from across the state, with ten member organizations from the coastal area. S.C.E.C. has several years of experience on issues involving the natural resources of the coastal area.

The draft environmental impact statement does not provide even one certain site for the disposal of the hundreds of acres of dredge spoils that will be generated by the project. On this basis, we question whether the draft environmental impact statement is severely premature or adequate. (1) Citizen review of a project of this nature depends on quantification of damages and specifics. The draft environmental impact statement indicates that the Environmental Protection Agency and the Corps will decide on a case-by-case basis what disposal sites will be used. The statement also indicates that, while it is possible that all disposal will be on uplands or perhaps on areas that can be made into marshland, it is also possible that all disposal could be in marshland. What further citizen review will be possible in the selection of sites, where the fate of all these marshes is to be determined? We calculate, based on Table 2 of the draft environmental impact statement, that perhaps one acre out of 500 of South Carolina's half-million acres of salt marsh could potentially be destroyed by the project. This quantity of destruction would have massive effects in the productivity of the estuaries of South Carolina, and probably would represent the largest damage the estuaries of the state will be likely to receive in future years. (2) We recommend that the draft environmental impact statement be revised to be an interim statement, and that it only consider those specific sites where emergency or urgent maintenance work must be performed to keep the waterway at its present depths until the question of spoil disposal has been resolved for the entire project. The proposed maintenance dredging project involves two phases, first, the dredging, and second, the disposal of spoils. The draft environmental impact statement considers only half of the project, and segments the impacts' real effect. We believe that the entire project must be considered in the preparation of an environmental impact statement for the project. (3)

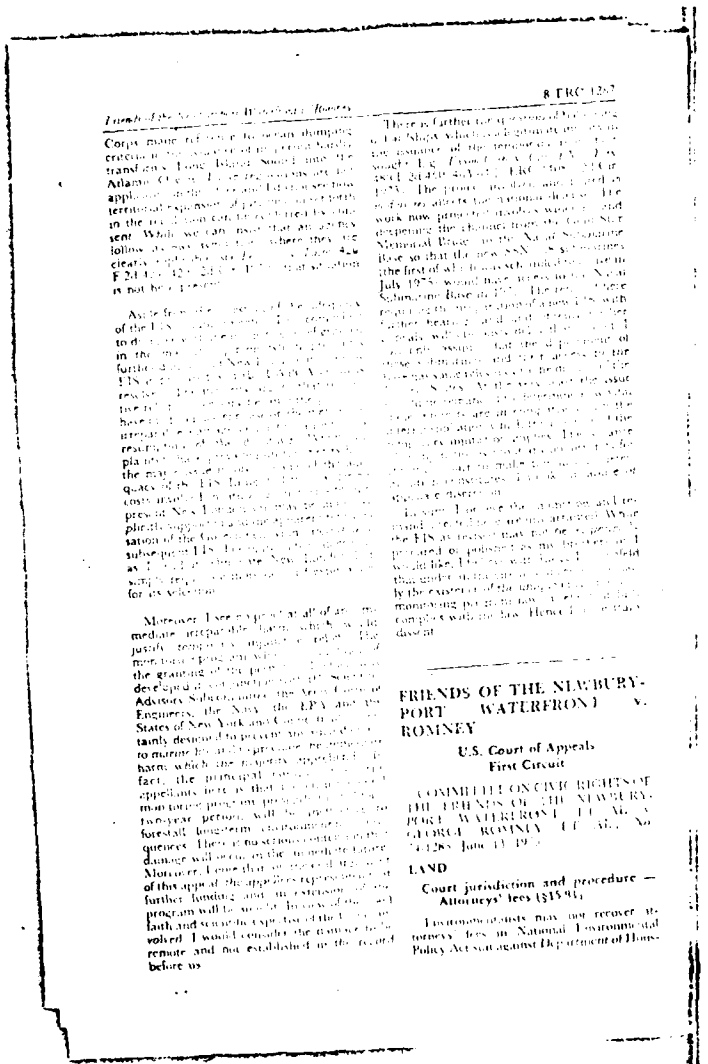
Another point we wish to address is the issue of alternatives. The draft environmental impact statement gives, on pages 71 to 73, only the alternatives of "no action" and alternative sites for spoil disposal. There is no consideration given to the possibility of maintaining the waterway at various lesser depths, even though the information in Table 1 indicates that the waterway already varies

considerably in depth, less than 12 feet. (4) There is no consideration given to the alternative of alternate modes of transportation for some of the larger commercial waterway users which may be the most dependent on channel depth. Railroad and highway use is an alternative which may demand far less public subsidy and involve far lower environmental costs. Use of larger, ocean-going vessels is also an alternative, if the waterway were decreased in maintenance depth. (4)

Certain data would be of significance in evaluating the project which should be available for inclusion. There is no economic information provided relative to the costs of dredging the waterway. (5) The draft environmental impact statement would be enhanced if the historical trends of costs of dredging typical sections were included. The statement should perhaps also make provision for alternatives based on cost limitations that could occur. The data on page 6 of the statement regarding groundings and economic damage to vessels using the waterway needs some type of quantification, and records about the causes and effects of the groundings should be available either from the Coast Guard or others who provide assistance in such instances. There is also no justification data for the project, listing the specifications of various vessels that utilize the waterway, particularly with regard to the required draft and width of the vessels. How many, and what type, of waterway user benefits from the 12 foot channel but would not be able to use a 10 foot channel, for example? Does any craft need a 12 foot channel---there is nothing in the draft environmental impact statement to demonstrate such a need. (4)

Sincerely,

Gerry Hutchison
President



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FRIENDS OF THE NEWBURYPORT WATERFRONT v. ROMNEY

U.S. Court of Appeals
First Circuit

COMMITTEE ON CIVIC RIGHTS OF THE FRIENDS OF THE NEWBURYPORT WATERFRONT et al., v. GEORGE ROMNEY et al., No. 74-1285, June 11, 1975

LAND

Court jurisdiction and procedure — Attorneys' fees (§15.94)

Environmentalists may not recover attorneys' fees in National Environmental Policy Act suit against Department of Housing

SOUTH CAROLINA
environmental coalition
P.O BOX 5761 COLUMBIA, SOUTH CAROLINA 29250

Colonel Harry S. Wilson, Jr.
Charleston District, Corps of Engineers
P.O. Box 919
Charleston, S.C. 29402

November 8, 1975

Dear Sir,

The South Carolina Environmental Coalition has reviewed the draft environmental impact statement for maintenance dredging of the Atlantic Intracoastal Waterway between Little River, S.C. and Port Royal Sound, S.C. and is submitting the following comments to the Charleston District office based on our review.

The South Carolina Environmental Coalition is a statewide non-profit environmental organization, composed of individuals and organizations from across the state, with ten member organizations from the coastal area. S.C.E.C. has several years of experience on issues involving the natural resources of the coastal area.

The draft environmental impact statement does not provide even one certain site for the disposal of the hundreds of acres of dredge spoils that will be generated by the project. On this basis, we question whether the draft environmental impact statement is severely premature or adequate. (1) Citizen review of a project of this nature depends on quantification of damages and specifics. The draft environmental impact statement indicates that the Environmental Protection Agency and the Corps will decide on a case-by-case basis what disposal sites will be used. The statement also indicates that, while it is possible that all disposal will be on uplands or perhaps on areas that can be made into marshland, it is also possible that all disposal could be in marshland. What further citizen review will be possible in the selection of sites, where the fate of all these marshes is to be determined? We calculate, based on Table 2 of the draft environmental impact statement, that perhaps one acre out of 500 of South Carolina's half-million acres of salt marsh could potentially be destroyed by the project. This quantity of destruction would have massive effects in the productivity of the estuaries of South Carolina, and probably would represent the largest damage the estuaries of the state will be likely to receive in future years. (2) We recommend that the draft environmental impact statement be revised to be an interim statement, and that it only consider those specific sites where emergency or urgent maintenance work must be performed to keep the waterway at its present depths until the question of spoil disposal has been resolved for the entire project. The proposed maintenance dredging project involves two phases, first, the dredging, and second, the disposal of spoils. The draft environmental impact statement considers only half of the project, and segments the impacts' real effect. We believe that the entire project must be considered in the preparation of an environmental impact statement for the project. (3)

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APPENDIX B

Aerial Mosaics of the South Carolina AIWW

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